

INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

INTERNATIONAL REVIEW OF THE SCIENCE AND PRACTICE OF AGRICULTURE

MONTHLY BULLETIN
OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

- 35 - Agriculture in the State of São Paulo, Brazil, According to the President's Message to the Legislative Congress (Session of July 14, 1921). — *Indústria e Comércio*, Year VI, No. 55, 30 pp. Rio de Janeiro, July 31, 1921.

DEVELOPMENT
OF
AGRICULTURE
IN
DIFFERENT
COUNTRIES

The greater part of the Message of the President of the State of São Paulo, Dr. Washington Luis PEREIRA DE SOUZA, is concerned with the economic and financial condition of the country during the difficult period beginning with the termination of the European War. He describes the measures taken by the Government to alleviate the serious crisis which is due: to the sudden fall in price of all articles of food, the decreased consumption of the countries that had previously been the chief importers of Brazilian products, the resumption of home production in those countries, the precarious condition of the Brazilian market owing to the sudden influx of North American goods, in quantities that far exceeded the demand, thus causing the export of gold coinage and the rise of the exchange which is already very high owing to the above mentioned causes, etc.

In São Paulo the crisis first affected stock-breeding and the industries which it is the basis: cold-storage plants, tanneries, boot-factories, etc., and it soon extended to cereal production and the cereal trade, cotton-growing and the cotton industry, etc. The coffee crisis was not occasioned, in the other cases, by an excess demand over supply, but by the fact, that there was a severe frost in the State on June 25, 1918, which destroyed the year's crop and reduced by 70 % the normal yield for the two following seasons.

The President has carefully studied the best means of organising credit Institutes in order to tide over the present difficulties and prevent their occurrence in the future. He deals chiefly with the necessity for founding a Central Bank of Credit and Discount.

[Abstract No. 135]

The taxes of the year 1920 brought in a total of 175 678 985 *milreis*, of which 27 266 750 were furnished by export dues, 13 120 by the sale of public lands and 380 246 by the sale of holdings to groups of colonists.

IMMIGRATION AND PROTECTION OF THE AGRICULTURAL WORKER. —

Immigration, which was suddenly arrested by the outbreak of hostilities in Europe, has now resumed its normal proportions. In 1920, 44 553 immigrants entered the State of São Paulo; of these, 32 484 landed at Santos.

The President considers that the present form of settler's contract cannot be improved upon, as it allows the settler working at the "fazenda" to save money and thus acquire the position of small-holder or merchant.

The "Patronato agrícola" protects the rights and interests of the rural workers, and acts as arbitrator in the case of difficulties arising between employers and their men; it gives advice to rural workers and land-owners, settles strikes etc.

AGRICULTURAL INSTRUCTION. — This is given at the following Institutions: a) The "Escola agrícola Luiz de Queiroz", which confers an agricultural diploma and had 103 pupils and 10 students attending lectures, in 1920; b) The "Instituto de Veterinária" opened in April 1920, with 17 students.

The State also provides for general instruction (both secondary and University teaching), as well as for the education of persons entering professions or trades.

GOVERNMENT MEASURES FOR THE ENCOURAGEMENT OF AGRICULTURE. — *Instituto agrônomo do Estado*. — The director of this Institute answers written or verbal questions regarding agriculture; in his chemico-bacteriological laboratory are carried out analyses of soils, fertilisers, insecticides, agricultural produce (which is also examined when adulteration is suspected), experiments in agricultural microbiology and plant biology, etc., and its services are also at the disposal of private individuals. The Institute has an experimental and demonstration coffee plantation, where the theoretical and practical study of the systematic cultivation of the coffee plant is carried out. There is also an experiment field for polyculture, where the improvement of farm-crops, the best methods of growing crops on a large scale, the best varieties of plants grown, the acclimatisation and selection of plants, the most favourable dates for sowing, etc. are thoroughly studied. In 1920 the Institute distributed 174 450 plants, including fruit-trees, ornamental plants, sugar-canes, coffee trees (cuttings, grafted stocks, rooted cuttings).

The *Forestry Service* supplies trees gratuitously to public Institutions, and at a low price to private persons. In 1920, it distributed 1 577 820 trees; of these 1 517 865 were forest-trees, and 59 961 fruit-trees.

The *Meteorological service* possesses 111 Stations in the State of São Paulo.

Propaganda of "Agricultural Protection". — The "Directoria de agricultura" not only brings to the notice of agriculturists the methods that experience has shown to be the best for obtaining good crops, but

also directly assists by its advice and efforts in lessening the injury caused to cultivated plants by pests and parasites. Chief among these is the Pink Cotton Boll-Weevil "*lagarta rosada*" (*Platyedra* [*Pectinophora*] *ossypiella*), an insect remarkable for its diffusion and the great injury it inflicts on the cotton crop.

Novius cardinalis has been introduced and become acclimatised, and its power of controlling *Icerya purchasi* ("pulção branco") has already been observed. Studies and experiments are being carried out with a view to the extermination of the "formiga saúva" (termite).

The "Diretoria de Agricultura" distributed in 1920 36 614 kg. of Paris green, 17 020 kg. of white arsenic, 9 216 kg. of flowers of sulphur, 1 279 kg. of copper sulphate, and 53 boxes of carbon disulphide.

The Service for the Inspection and Sorting of Cotton Seeds continues the inspection of the ginning establishments, in order that no seed infected with bollworm may be planted: 327 of these establishments were inspected. The trucks in which the sorted seeds are transported are also disinfected.

Sale of Agricultural Implements at Cost Price. — 29 007 picks and spades, 10 301 pickaxes were sold as well as pitch-forks scythes, drills, PLANET harrows, etc.

Seed Distribution. — In 1920, 8 709 kg. of seed were distributed to 2 436 persons.

Publications Service. — The "Secretaria de Agricultura" of the State of São Paulo has 3 official publications: *Boletim de Agricultura*, *Boletim de Industria e Commercio*, *Boletim de Importação e Exportação do Porto de Santos*. The number of publications (including periodicals) distributed in São Paulo amounted to 220 000.

Coffee Propaganda. — This work is entrusted to different companies; the contract for Japan being given to the "Companhia Café Paulista" of Tokyo, and that for the United States to the "Sociedade Promotora".

Measures for the Encouragement of the Stock-Breeding Industry. — In 1920, the "Diretoria de Industria Pastoral" distributed over 200 000 doses of vaccines against infectious cattle-diseases. This office was wound up in 1920, and since then the vaccines have been sold by the Ministry of Agriculture to the breeders entered on its registers.

The Police Veterinary Service was instituted by Decree No. 3141 of January 13, 1920. This Service has succeeded in confining rinderpest to a very limited area, and in rapidly suppressing it; the disease having been rife throughout the state of São Paulo at the beginning of 1921. The method employed consisted in the marking out of the infected area and the destruction within this area of all animals likely to contract the disease; 434 cattle were slaughtered and their owners indemnified.

Good results have been obtained at many Stud Stations. At the "Porto de Seleção do Gado Nacional" the work of improving the Caracú cattle has been continued (1) and at the "Haras paulista" the native horse

(1) See R. 1911, No. 1825; R. 1912, No. 1438; R. 1916, Nos. 1093 and 1105; R. 1917, No. 1041. (Ed.)

is being improved (1). The "Fazenda de Criação" of Barnery is chiefly engaged in pig-breeding, but pure Schwytz cattle are also bred there, the animals doing exceedingly well (2). The "Fazenda Sant'Anna" has become the centre of Dutch cattle breeding. The pure Red Poll race is also bred at the "Fazenda de Criação do Amparo"; the pastures and breeding methods in Brazil suit this breed of cattle. At the "Fazenda de Criação" at Itapetininga, Hereford and Durham cattle are reared and also sheep. The "Fazenda Campininha" is set apart for the breeding of the native "gado mocho" cattle and to its improvement by selection and proper feeding. It is also engaged in the intensive and extensive cultivation of forage plants either native, or capable of acclimatisation. The results already obtained have been encouraging. The "Posto zootechnico" of Botucatu and São Paulo respectively are two popular Stud Stations; the latter is also a vaccination Station.

A cattle show was held on April 12. The first class animals (excellent) fetched 20 *milreis* per *arroba* (1 *arroba* = 33 lb. = 15 kg.); the second class (good), 18 *milreis*; the third class (fair), 16 *milreis* and the fourth class (disqualified), 15 *milreis* respectively per *arroba*.

AGRICULTURAL PRODUCTION. — In 1919-1920, the frequent and abundant rainfall was very beneficial to cereals, especially to rice. On the other hand the cotton crops were very small (only half the normal crop being produced on account of a reduction of the area under cotton due to the fall in prices and the attacks of parasites). Table I gives the chief crops obtained during the year in question and their value in *milreis* (4 paper *milreis* = about 1 s. 6 d.).

TABLE I. — *Agricultural Production in the State of São Paulo in 1919-1920.*

Products	Amount	Value in <i>milreis</i>
Coffee	—	278 908 640
Unginned cotton qx	688 245	43 588 840
Sugar sacks	528 821	33 971 161
Brandy and alcohol hl.	953 880	49 406 877
Tobacco qx	32 326	68 807
Paddy sacks	4 686 015	82 005 262
French beans "	2 859 377	40 031 278
Maize "	15 963 900	183 854 850

The value of the total agricultural production of the preceding year had been 955 606 300 *milreis*.

(1) See R. June 1921, No. 469. (Ed.)

(2) See R. Oct. 1921, No. 1031. (Ed.)

THE FROZEN MEAT INDUSTRY (1). — This industry is at present carried on at the Refrigerating Stations belonging respectively to the "Companhia Frigorifica e Pastoral" (at Barretos), the "Continental Products" (Osasco), the "Companhia Frigorifica de Santos" (Santos), and Messrs Armour (near São Paulo).

The capital employed in these establishments is 36 million of *milreis* the three first used in 1919:

238 664 cattle of a dead weight of	53 532 911 kg.
65 182 pigs " " " "	5 025 194 "
2 253 sheep " " " "	30 908 "

their output being: 34 748 747 kg. of frozen meat; 4 609 279 kg. of chilled meat; 13 016 400 kg. of fresh meat; 2 458 679 kg. of tinned meat.

The value of this output was about 70 million *milreis*, as against 56 million in 1918.

The exportation of meat from the port of Santos began in 1914 with first consignment of 1415 kg. and has progressed as follows:

Years	Frozen meat		Tinned meat	
	Weight in kg.	Value in <i>milreis</i>	Weight in kg.	Value in <i>milreis</i>
1915	7 946 745	5 739 112	93 325	132 700
1916	18 688 846	15 716 962	362 173	612 719
1917	29 134 755	26 388 613	1 097 129	1 738 224
1918	32 654 838	32 754 404	2 791 181	5 222 855
1919	32 033 736	35 606 480	2 877 745	6 683 553
1920	32 710 000	36 532 000	570 172	1 425 093

The chief markets for Brazilian frozen meat are: Italy, Great Britain, Egypt and France, the tinned meat mostly goes to Belgium and Great Britain, and the sale of this commodity has been much reduced by a loss in 1920 of the North American market.

INDUSTRY AND COMMERCE. — The value of the output of the manufacturing industries of the State of São Paulo continues to increase; from 74 millions of *milreis* (in round numbers) in 1915, it rose in 1919 to nearly 113 millions.

In 1920, the value of the exports was 53 250 000 *pounds sterling*, or 360 million paper *milreis*, with a decrease of 227 million paper *milreis* as compared with the preceding year. This drop is to be attributed chiefly

(1) R. July 1921, No. 767. — Regarding the exportation of frozen and tinned meat from Brazil to Italy see: Dr. DEOCLECIO DE CAMPOS, A importação de carnes congeladas na Itália, in *Boletim do Ministério das Relações Exteriores, República dos Estados Unidos do Brasil*, No. 9, pp. 49-2. Rio de Janeiro, 1920. (Ed.)

to coffee of which 9 426 335 sacks (of 60 kg.) of the value of 946 576 million of *milreis* were exported in 1919 as against 8 480 887 sacks of the value of 671 363 million *milreis* in 1920.

In 1920, the export figures for cotton were the highest hitherto registered being 11 260 tons of the value of 38 689 000 *milreis*, or about double the amount exported in 1919; 83 331 tons of rice of the value of 59 893 000 *milreis* were exported as against 8 846 tons in 1919.

The sea trade of the Port of Santos is now as great as before the War.

SANITARY SERVICE. — The Public Health Services continue to insure the interrupted improvement of the hygienic conditions of the country. They have at their disposal: vaccinogenic, bacteriological and Pasteur institutes, as well as factories where State quinine is made; services for the inspection of food sold to the public (with Laboratories for the analysis of chemical products and foods); a corps of Sanitary Engineers; a Service for the Inspection of Chemists' shops; an Inspector of general prophylaxis; a Central Institute for Disinfection; a Hospital for Infectious Diseases, etc.

These Services also provide for the hygienic protection of infant

136 — **The Part Played by the Rabbit and Other Domestic Animals in Protecting Man from Mosquitoes.** — LEGENDRE, J., in *La Nature*, No. 2487. Paris, December 3, 1920.

There have been previous references to the rôle of animals in protecting man against the bites of the mosquitoes that convey malaria. Domestic animals living in the neighbourhood of human beings are attacked by *Anopheles maculipennis* in preference to the latter (1). The author, basing his opinion upon the observations made in collaboration with OLIVEAU, states that the rabbit is very useful in this connection. In many districts of France, the rabbit enclosures have been found to be infested with *Anopheles* when the stables and houses near were completely free even in summer. The young rabbits are bitten in the hairless parts of their bodies, viz., the ears and muzzle.

CROPS AND CULTIVATION

137 — **Effect of Lake Michigan (United States) upon Rainfall during the Crop-Growing Season.** — ESULENAX, C. H., in *Monthly Weather Review*, Vol. 49, No. 9, pp. 500-56 figs. 2. Washington, September 1921.

Severe drought conditions prevailed during the early and middle crop-growing months of 1921 at Ludington (Michigan), and the storms seemed in some degree to avoid the shores of Lake Michigan although heavy rain fell in the neighbourhood.

These facts led the author to undertake a series of investigations with a view to determining whether the lake diminished the total rainfall.

The data obtained showed that for the three months May, June and July, there is an area of maximum rainfall in the interior of extreme Southern Michigan. In August and September this area is absent.

(1) See *R.* Jan. 1920, No. 1. (Ed.)

The rainfall is greater on the eastern than on the western shore, whereas an area of maximum distribution is found in the interior of Wisconsin (on the west of the lake).

The lake thus seems to cause a certain decrease in the rainfall which must be attributed to the wind blowing with greater force in the afternoons, during May, June and August and thus producing a lateral movement preventing the vapour-laden air from rising and its moisture from condensing in the form of heavy rain.

138 - **The Fertilising Value of Rain and Snow (1): Researches in Canada.** — SHURT, F. T. (Chemist of the Dominion of Canada), Chemist's Report, in *Rapport des Fermes Experimentales du Dominion. Fiscal Year Ending March 31, 1920*, pp. 58-59. Ottawa 1921.

A study begun in 1907 with a view to determining the sum of available nitrogen annually supplied per hectare by rainwater and snow; the water was collected and the analyses were made at the Central Farm in Ottawa. All the rainfall and the snow that have fallen during a year are separately measured and analysed. This latter is an important point for it was found at the beginning of the work, that the analysis of samples taken every month and preserved by means of an antiseptic does not give accurate results.

The laboratory work was limited to determining the free ammonia, albuminoid ammonia, and nitrous and nitric nitrogen. These three forms are those which make up the nitrogenous compounds present in atmospheric precipitations which are able to supply the crops with fertilising substances.

During the year ending February 29, 1920, 79 samples of rain and 24 of snow were analysed. The total precipitation registered for the year March 1, 1919—February 29, 1920 was 844 mm. of which 594 mm. were rain and 2502 mm. were snow (10 mm. of snow equals 1 mm. of rain). The total amount of nitrogen supplied by these precipitations was 7 971 kg. per hectare.

This enquiry brought to light many facts of scientific interest, but it will suffice in this short account to give such data only as are of importance from the agricultural standpoint. These are set out in the following Table together with similar data for the 2 preceding years for purposes of comparison, and the mean for the first decade of this experiment.

The rain and snow fall for the year are about normal. The mean for the 29 preceding years is 855.5 mm., but the amount of nitrogen supplied slightly exceeds the average given during the first 10 years of these researches. The latter show that the atmospheric precipitations in the neighbourhood of Ottawa supplied about 7.28 kg of available nitrogen per hectare. Of this amount 85 %, or about 6.6 kg., are supplied by the rain. The value of the nitrogen derived from the rain and the snow may be estimated, at a moderate computation, as 22.40 fr. per hectare (at par).

(1) See R. 1912, Nos. 39 and 620; 1914, Nos. 202 and 494; 1915, No. 677; 1916, No. 7; 1918, No. 956. (Ed.)

Rainfall and Snow (in mm.) and Amount of Nitrogen supplied (in kg. per ha

	Total amount m. m.	Nitrogen supplied		
		by the rain	by the snow	total
Year ending February 28 1918.	834.64	5.285	1.725	7.010
Year ending February 28 1919.	903.99	5.520	1.026	6.546
Year ending February 29 1920.	844.04	6.618	1.353	7.971
Average of the 10 years ending on February 28, 1917.	842.52	6.142	1.233	7.375

139 - Influence of Atmospheric Factors upon the Composition of Wheat. -- See No. 160 of this Review.

140 - Hard-Pan in the Apulian Soils and Its Origin. -- DE DOMINICIS, A. (Laboratorio di Chimica agraria, della R. Scuola Sup. di Agricoltura, Portici), in *Annali della Reale Scuola Superiore di Agricoltura in Portici*, Second Series, Vol. XVI, p. 18. Portici, 1920.

In a preceding paper the author (1) gave an account of the results of his researches on the hard-pan (« crosta pugliese ») of the soils of Apulia especially in the district of Bari, where in many places the pan firmly adheres to the calcareous tufa that forms a rocky massive subsoil. The special conditions prevailing in the country round Bari are however not generally found in the rest of Apulia, for here the hard-pan rests for the most part on a friable, more or less finely divided calcareous soil into which roots can easily penetrate. This being the case the author decided to extend his researches to the other parts of Apulia and see how far the results obtained agreed with or differed from those of his previous investigations.

He employed the same methods as before, examining on the spot the position, conditions of formation, composition and properties of the hard-pan, its probable origin and the consequences of its possible removal.

These new researches bring out the general significance of the data previously obtained and also prove that hard-pan is not a phenomenon confined to rocky, massive sub-soils. They show that the formation of Apulian hard-pan in particular, and of all superficial calcareous pans in general, always depends upon the same set of conditions: a) the opportunity for their formation at the point of contact of the soil and the subsoil -- b) a dry climate and a subsoil consisting of a rocky mass rich in calcium carbonate and with a very active capillary system -- c) calcium carbonate dissolved in the capillary water, and the presence in the circulating water of sufficient colloidal substances in the form of reversible hydrogels and hydrosols -- d) the co-existence of all these conditions which entails: 1) similar properties viz. a) a permeability limited to the first few moments of the action of the water and only to be detected by the application of certain methods -- b) a capillarity not extending beyond the thin coating on the

(1) See R. March 1920, No. 293. (Ed.)

surface of the crust; 2) similar chemical composition, the chief constituents being: a) calcium carbonate derived from the subsoil; b) sandy and clayey matter from the soil.

Hard-pan is thus always formed in the same way and is due to the coagulations that take place when the colloidal substances found as hydrosols in the circulating water come into contact with the bivalent electrolyte, calcium carbonate, dissolved in the capillary water. The content and proportions of the crust depend upon the capacity of calcium carbonate absorption possessed by the resulting mass. These principles have been confirmed by new facts revealed by the present researches which have also shown how Apulian agriculture can be assisted by the improvement of both compact calcareous subsoils and non-massive calcareous subsoils. The first are more difficult to deal with than the second. Compact ground is however best broken up by the use of explosives, while friable soils only need superficial clearing.

- 41 - Researches made in Japan on the Gases Formed in Rice Fields during the Decomposition of *Astragalus sinicus* used as a Green Manure. — ONODERA, S., in *Berichte des Ohara Instituts für Landwirtschaftliche Forschungen in Kuraschiki, Province of Okayama, Japan* Vol. I, Part 5, pp. 557-558, figs. 12. Kuraschiki, 1920.

Astragalus sinicus L. is the plant chiefly used for green-manuring in Japan. Although it forms 71 % of the total of the Japanese green manures, it sometimes injures the rice crops, either on account of the nature of the soil or on the amount of the dressing applied. The author has already had occasion to try and discover the cause of its ill effects; it would appear that these are to a certain extent due to the salts of the organic acids liberated during the decomposition of *Astragalus sinicus*. He subsequently found that the decay of this plant in the rice-fields gave rise to the formation of much larger quantities of gas than would be supposed. Much work has been done on the nature of soil gases; and the researches of LEWY, BOUSSINGAULT, RUSSELL and APPELYARD may be mentioned in this connection.

	Carbon dioxide	Oxygen	Nitrogen	
Cultivated soil . . .	$0.25 \pm 0.1\%$	$20.6 \pm 0.2\%$	$79.2 \pm 0.1\%$	RUSSELL and APPELYARD, 1919
Winter meadow . . .	1.57	18.02	80.04	
Atmospheric air . . .	0.03	20.97	79.90	LEWY and BOUSSINGAULT, 1853
Cultivated soil . . .	0.90	19.60	79.50	

According to RAMANN, the air of the soil contains 0.3 % of carbon dioxide, which is more than is present in atmospheric air, but soil air is free from methane and hydrogen. Researches on the gases of rice-fields have been made in India, though no author has considered the part played by

Astragalus sinicus in gas production. The author collected all the gases liberated during the summer of 1918 by the soil in a pot manured with *Astragalus sinicus* and then turned over. In 1919, he collected the gases from a rice-field fertilised with the same green manure. They included the gases from the slightly stirred superficial layer, the gas spontaneously liberated and the gases from the sub-soil. The soils studied were sandy-clays and clays.

The author's conclusions showed that *Ast. sinicus*, when used as a green manure for rice fields, set free large quantities of gas consisting essentially of methane, carbon dioxide, nitrogen and a small amount of hydrogen, the latter disappearing at the end of the decomposition process. Sometimes a little oxygen was found, which probably did not come from the decomposition of *Astragalus* but was a product of the carbon assimilation of the algae. If *Ast. sinicus* is left to decay in a rice-field, the gases of the subsoil contain more carbon dioxide than methane while most of the nitrogen is to be found in the upper layer. *Ast. sinicus* decomposes more rapidly in sandy soil than in clayey-sands and more quickly in the latter than in clays, hence the liberation of gases comes to an end sooner in sandy soil than in others.

It should be mentioned, that no liberation of gas from the control plots was observed and even had they formed a small quantity it would have consisted chiefly of oxygen, nitrogen and sometimes of small amounts of carbon dioxide; further, given its composition, this gas must be attributed to the carbon assimilation of the algae. It should be noted that the application of a little toluene soon stopped the liberation of gas.

142 - **The Inversion of Saccharose by the Mineral Acidity of the Soil.** — Otsugi, S., in *Berichte des Ohara Instituts für landwirtschaftliche Forschungen in Kurashiki, Province of Okayama, Japan*, Vol. I, Part 5, pp. 579-597. Kurashiki, 1920.

The power of inverting saccharose, a property possessed to a high degree by soils containing much mineral acidity, had already been demonstrated first by the author alone, and then in collaboration with RICE (1), as well as by SHARP and HOAGLAND. As the question had not been explained thoroughly, the author made further experiments using 11 samples of soil. He treated 5 gm. with 100 cc. of 5 % sugar solutions for 1 hour at 85° C, and then made the following determinations for the filtrate: the inverting power of the soil — the effect of the acidity of the soil extract — the effect of the temperature — the effect of various chemical agents — the effect of the different proportions of the degree of the acidity of the soil and its inverting property — the rapidity constant of the inversion reaction caused by acid soils.

The author then sought to discover the substances, whether extracts or insoluble (fine soil particles, silicic acid gel, or silicate of alumina), that might possibly cause the inversion of sugar.

His researches proved that a soil containing no mineral acidity un-

(1) See R. Feb. 1919, No. 158. (Ed.)

doubtedly has the power of inverting saccharose to a measurable extent, 1 to 9 gm. of invert sugar being obtained per 100 of saccharose. This property of inversion is to be attributed chiefly to the soil particles and is strictly connected with the degree of acidity of the extract obtained by treatment with a saline solution of potassium chloride.

The inversion produced by acid soil is a mono-molecular reaction similar to that effected by acids; on the other hand, aqueous extracts of acid soils are found to contain a little aluminium sulphate or chloride with acid reaction, but producing very little effect on the saccharose, whereas the gel of silicic acid can invert saccharose, but is not found in determinable quantities in acid soil. There is, however, an acid silicate (obtained by the precipitation with an aluminium salt, of an alkaline salt in an acid medium) that inverts saccharose and is the substance to which the great inversion power of acid soil is chiefly due.

The concentration of the hydrogen ions of aqueous acid soil extracts is not sufficient to cause inversion on the part of the soil, unless it is to be assumed that these ions are more concentrated in the film surrounding the soil particles than is any other part of the soil solution.

- 43 - **The Prevention of Dust Storms in Canada.** — MUNRO, W. A. (Régisseur de la Ferme Expérimentale, Rostern Sask.), in *Rapport des Fermes Expérimentales du Dominion. Fiscal Year Ending March 31, 1920*, pp. 171-172. Ottawa, 1921.

METHODS
OF
CULTIVATION

As much damage had been done in 1919 throughout the greater part of Saskatchewan by the removal of soil by winds, the author devoted his attention to a careful study of the question. From his observations and the results of his experiments, he reached the following conclusions:

- 1) Dust storms can be prevented to some extent by liberally manuring every 4 or 6 years.
- 2) Sowing grass-seed once in 6 years and allowing the grass to grow for at least 2 years is useful.
- 3) A clump of trees protects the ground on the leeward side for a distance of 15 m. for every 30 cm. of the trees' height.
- 4) No garden can succeed, unless it is protected by good wind-breaks in the shape of hedges.

- 44 - **The World's Nitrogen Products.** — *Journal of the Society of Chemical Industry*, Vol. XL, No. 15, pp. 285-287. London, August 15, 1921.

MANURES
AND
MANURING

The following data have been taken from the Statistical supplement to the Final Report of the Nitrogen Products Committee of the Ministry of Munitions. They show the present sources of the supply of these products which are most essential to agriculture and bring out the fact that the nitrogen fixation industry will in future be the chief source of nitrogen for the whole world, as can be seen from Table II.

The demand for fixed nitrogen is growing at a greater rate than the output capacity. As Table I shows, the potential output of the cyanamide plants is greater than that of the synthetic ammonia plants.

TABLE I. — *National Internal Sources of Fixed Nitrogen in Different Countries.*

Country	Population	Metric tons of nitrogen					Tons nitrogen per million population
		From by-product sources	From fixation plants			Total	
			Arc	Cyanamide	Synthetic ammoniac		
Germany . . .	65 000 000	150 000	4 000	120 000	300 000	574 000	8 830
Norway and Sweden . . .	8 000 000	—	30 000	28 000	—	58 000	7 250
United Kingdom . . .	45 000 000	100 000	—	—	—	100 000	2 240
Canada . . .	7 200 000	3 000	800	12 000	—	15 800	2 200
Switzerland . . .	3 800 000	—	700	7 000	—	7 700	2 030
France . . .	40 000 000	15 000	1 300	58 000	—	74 300	1 850
United States . . .	103 550 000	105 000	300	40 000	8 000	153 300	1 480
Austria . . .	51 000 000	10 000	—	22 000	—	32 000	630
Italy . . .	35 000 000	3 000	1 200	18 000	—	22 200	630
Other Countries	—	27 000	—	20 000	—	47 000	—
Totals . . .	—	413 000	38 300	325 000	308 000	1 084 300	—

Table III gives a summary of the results of the World's Production of Fixed Nitrogen.

TABLE III. — *World's Production of Fixed Nitrogen.*

Sources	Metric tons of nitrogen			
	1919	1913	1917	1920
<i>Natural sources:</i>				
Chilean nitrate	300 000	400 000	400 000	500 000
By-product industry	240 000	353 000	400 000	400 000
Totals . . .	540 000	753 000	800 000	900 000
<i>Fixation process:</i>				
Arc and miscellaneous	3 000	18 000	30 000	38 300
Cyanamide	2 500	60 000	200 000	325 000
Synthetic ammonia	—	7 000	110 000	308 000
Totals . . .	5 500	85 000	340 000	671 300
Grand total . . .	545 500	838 000	1 140 000	1 561 300
Proportion of total obtained by fixation processes	1 %	10 %	30 %	43 %

TABLE II. — *The world's Resources in Nitrogen Production (Pre-War and Post-War Statistics).*

Source of supply	1912			1940		
	Output in long tons of product	Output in metric tons of nitrogen	Percentage of total output	Productive capacity long tons of products	Productive capacity metric tons of nitrogen	Percentage of total productive capacity
Chili nitrate industry (assumed 95 % product)	2 628 367	411 329	57.5 %	3 013 518	471 000	30.2 %
By-product industry (sul- phate assumed 21.5 % am- monia)	1 249 449	272 007	38.0	2 047 687	413 000	26.6
Fixation industry:						
a) assumed 18 % N	128 563	22 435	3.1	1 805 432	325 000	20.9
b) nitrate of lime and arc process products (assumed 13 % N)	76 200	9 907	1.4	295 046	35 300	2.5
c) synthetic ammonia . . .	—	—	—	1 527 048	308 000	19.8
Total: of fixation industry	204 763	23 342	4.5	3 627 526	671 300	43.2
Grand total	4 082 579	715 678	100.0	8 688 731	1 555 300	100.0

145 - The Condition of the Nitrogenous and Phosphatic Fertiliser Industries in Germany. — UNGEWITTER, in *Chemiker-Zeitung*, Year XLV, No. 147, p. 191. Cöthen, December 8, 1921 (1).

The pre-War consumption of nitrogen in Germany amounted to about 240 000 tons, of which 40 000 were used in industry, and 200 000 in agriculture, not including the nitrogen supplied to the land in the forms of dung and green manure. This nitrogen was obtained: *a*) by the importation of the nitrate of sodium (in 1913, some 7 500 000 tons were imported, equivalent to 116 250 tons of nitrogen); *b*) by the importation of nitrate of lime (in 1913, 20 000 tons representing 2 400 tons of nitrogen were imported); *c*) by the home production of sulphate of ammonia (in 1913-1914, 500 000 tons corresponding to 110 000 tons of nitrogen were made); *d*) by the home production of calcium cyanamide (amounting in 1913-1914, to 50 000 tons representing 10 000 tons of nitrogen). During the War, these importations ceased. They were however replaced by the manufacture of ammonia on a large scale by the HABER-BOSCH high-pressure method, and of calcium cyanamide according to the FRANK-CARO process, but the ever-increasing need of munitions for the army encroached upon the supply of nitrogenous fertilisers for agriculture. After the revolution the nitrogen production fell to about $\frac{1}{3}$ of the maximum output during the War, but it has gradually improved, so that according to the data of the Food Ministry, the amount of nitrogen supplied for agricultural use from 1914 to 1920 was as follows (in tons):

1914	1918	1919	1920
200 000	92 000	115 000	158 000

In 1913 and 1914, 774 000 and 31 000 tons of nitrate of sodium respectively were imported into Germany. The maximum nitrogen output of the HABER-BOSCH process is estimated at 300 000 tons and that of the calcium cyanamide process at 100 000. The maximum production of the coal distilleries and gas factories may be reckoned at 100 000 tons of nitrogen, so the total maximum annual amount at disposal would be 500 000 tons. It must not be forgotten, that the Joint-Stock Nitrogen Co. ('Stickstoff Gesellschaft m. b. H. '), was founded in order to assist in providing nitrogenous fertilisers for agricultural purposes.

The question of supplying the raw materials necessary to the phosphatic fertiliser industry is at present a matter of the greatest difficulty. The last tons of the large pre-War reserve of mineral phosphate were already exhausted in 1916. Since that date until the middle of 1919, all the phosphates at the disposal of the industry were of inferior quality; some coming from the Lahn deposits, and the rest from other sources. In 1913, 88 superphosphate factories used 900 000 tons of crude phosphate coming almost

(1) See R. Sept. 1921, No. 890; R. Nov. 1921, No. 1091. (Ed.)

exclusively from over-seas; during the War 5 factories failed and 28 were obliged to shut down owing to lack of raw material. It was not until the last six months of 1919, that it was again possible to import material of good quality, and then the price was prohibitive, for Government aid was refused in the first instance, although it was then of paramount importance. In 1920, 133 000 tons of mineral phosphate were imported, and from the beginning of 1921 both the Government and the industry have made every effort to restore the importation of raw material to its normal condition; 61 superphosphate factories have thus been able to resume work. The amount absolutely necessary for the present season is 500 000 tons. In 1919-1920, the quantities of phosphatic fertilisers supplied to agriculture compared with the amount furnished in 1913-1914 were as follows (calculated as phosphoric acid).

	1913-1914	1919-1920
Basic slag	391 000	118 000
"Rhenania" phosphate	—	3 700
Superphosphate	214 000	12 000
Bone-meal	20 000	4 300
	625 000	138 000

146 - **Manurial Value of Tobacco Waste.** -- SHUTT, F. T. (Chimiste du Dominion du Canada), Report of the Minister, in *Rapport des Fermes Expérimentales du Dominion*. Fiscal Year ending March 31, 1920, pp. 52. Ottawa 1921.

The waste of the by-products of tobacco factories (dust, ribs, etc.), possesses an appreciable but uncertain value as an insecticide and fertiliser. Potash and nitrogen are the chief nutritive substances it contains. When these residua are bought for use, an analysis giving the percentage of these elements should be obtained, for the poorest types, such as tobacco dust, often contain large quantities of sand. The following analyses show the differences in composition and hence in value of these waste products.

Analyses of the Residua of Tobacco Factories.

	Water	Ash	Loss on incineration	Insoluble residue	Phosphoric acid	Potash	Nitrogen
Dust of tobacco No 1	2.29 %	76.30 %	21.41 %	70.57 %	0.12 %	0.65 %	0.59 %
Dust of tobacco No 2	4.25	44.57	51.18	34.75	0.40	1.62	1.39
Dust of tobacco No 3	3.17	63.44	33.39	55.20	0.19	1.07	0.89
Stalks of cigarette tobacco	7.87	18.53	73.60	0.55	0.63	4.49	1.04
Stalks of "Burley"	7.03	22.56	70.41	0.38	0.92	7.69	2.89
B. E. Stalks.	7.45	22.57	69.98	0.43	0.52	7.60	1.47
Tobacco dust.	1.97	15.11	78.40	—	—	—	—

- 147 - **United States Production of Fish Scrap and Meal.** — *The American Fertiliser*, Vol. LX, No. 10, p. 92. Philadelphia, Nov. 5, 1921.

According to the *Report of the Bureau of Fisheries, Department of Commerce*, the estimated production of fish and whale scrap and meal in 1920 was 130 000 tons, a material increase over previous years. Of this amount 16 898 tons are credited to the Pacific Coast States and Alaska. On the West Coast, as a result of the heavy demand for fertiliser material, more than the usual amount of scrap was used for this purpose. In the "menhaden" industry of the Atlantic coast, the value of the Bureau's assistance in encouraging the production of fish meal has been greatly appreciated. At least 5 000 tons of meal were turned out by the producers in 1920 and considerable quantities of unground scrap are stated to have been sold to manufacturers interested in supplying stock feeds. The Bureau of Animal Industry of the Department of Agriculture has continued its hog-feeding tests, using various fish meals, and samples have been supplied to some fifteen State experiment stations with satisfactory results. The experiments in progress include the feeding of meal with high oil content, samples without removal of natural oil with additional oil added and meal made from decomposed fish. If these tests yield satisfactory results, the producers of fish meal should be reasonably assured of markets for their product as the farmers have become acquainted with its merits. The whaling companies have recently expressed an interest in the manufacture of whale meal and have provided material for a feeding test.

Considerable quantities of fish offal and waste fish incident to the New England fisheries remain unutilised, and in some cases its disposal is an item of no little expense to the producer. Lack of a regular supply makes the operation of the larger reduction plants impracticable, and the smaller plants do not appear to be wholly satisfactory for the proper reduction of some of the raw materials in greatest abundance. The Bureau appreciates the need of solving the problems in this field and hopes to be in position to take them up in the near future.

- 148 - **The Sébakh of the "Koms" or "Sébakh koufri", in Egypt.** — MOSSERI, V. M. (Vice President of the Egyptian Institute), in *Bulletin de l'Institut d'Egypte*, Vol. III pp. 75-92, fig. 1. Cairo 1921.

"Tafla", "marog" and "sébach" from the "koms", or "sébach koufri", are nitrogen earths forming the chief natural fertilisers of Egypt. "Sébakh" from the "koms" is the most widely-used, and was employed at an earlier date than either of the others. "Sébakh" means manure and "kom" signifies heap or mound; this fertiliser is also called "sébach koufri" or simply "koufri". It is a pulverulent substance used for manuring or improving the soil and comes from the rubbish heaps that gradually accumulate near towns or villages when they have repeatedly been destroyed and rebuilt on the same site during the course of centuries. The author had the opportunity of examining over 250 "koms" of

"koufri" and gives a few general ideas acquired from his investigations.

The "koufris" consist for the most part of rubbish, and they are poor fertilising substances, but they differ according to the locality, the mound from which they are taken, or even the stratum of the same mound. The "sébach" of the "koms" can be applied as a fertiliser or for improving the land, but in either case it nearly always has some perceptible effect upon the soil which may be favourable or unfavourable according to circumstances. It is always well, if not indispensable, to determine the composition of the "sébach" before applying it. We may consider two ways in which "koufris" are used.

1) In the case of normal alluvial soils, "koufri" is applied as a fertiliser and should chiefly be regarded as a source of nitrogen. Its importance in this respect depends on the nitric nitrogen it contains (under the form of nitrate of sodium) which varies from traces to 35 %.

Ammoniacal nitrogen is only present in such negligible quantities that it can be disregarded without causing serious error in the calculation, and organic nitrogen can be left out of the reckoning as its nitrification is doubtful, and in any case too slow.

2) For all other soils, "koufri" may be looked upon as a source of nitrogen, phosphoric acid or potash. It is however very rarely that these substances are present in the proportions required to make a complete fertiliser, hence it is nearly always necessary to add some other fertiliser, preferably a nitrogenous. The amount of total nitrogen must here be taken into account and also the quantity of organic substances present which by their physical action, may become of considerable importance as affecting the compactness or friability of the soil. As regards the phosphoric acid which is present to the extent of 1.3 % of phosphoric acid soluble in citrate of ammonium), and the potash (0.096 % to 2.280 %, soluble in 1 % citric acid), only the available amount in the "koufris" has to be determined and reckoned.

It must not be forgotten, that the "koufris" always contain soluble salts (common salt to the amount of 0.57 to 13.40 %). Some of these are injurious, while the others are either innocuous, or beneficial; hence it is necessary to note the nature of these salts and the proportions in which they are present. It is not always possible to know beforehand how much of these salts the "koufri" can contain without rendering it unusable, but this depends upon the nature of the soil to be manured or improved, the drainage conditions, the course of the underground water, etc. If the soil is permeable, well-drained, either naturally or artificially, and the level of the subterranean water is fairly low, the "sébach" can safely contain rather large quantities of injurious salts. Should the contrary be the case, care must be taken to avoid applying an appreciable amount of these substances to the soil.

The author mentions the uses that can sometimes be made of the salts of the "koufris" and their value for improving more or less alkaline land.

- 149 - **Distribution of Manganese in the Organism of Higher Plants.** — BERTRAND, G. and ROSENBLATT, M., in *Comptes rendus de l'Académie des Sciences*, No. 22, pp. 1118-1120. Paris, November 28, 1921.

After having proved that manganese is of general occurrence in plants (1), the authors endeavoured to ascertain the manner in which this metal is distributed, both in the different organs of plants, especially of the higher plants, and also in the various parts of any specimen gathered at a given growth period.

The results obtained show that a large amount of manganese is present in the organs that are the seat of active metabolism in the reproductive organs, leaves, young shoots and in all the organs containing chlorophyll as well as in seeds.

- 150 - **The Manganese Content of Seeds of Dutch Origin.** — WESTER, D. H., in *Biochemische Zeitschrift*, Vol. CXVIII, pp. 158-163. Berlin, 1921.

There is good reason to believe that manganese plays a considerable part in plant metabolism, but though the manganese question, as it may be called, has been the subject of considerable investigation during the last 25 years, it has not yet been completely solved. Hardly anything is so far known as to the presence of manganese in the plants, animals, waters or soils of Holland; seeds have not generally been studied from this point of view and there are only a few scattered data on the subject.

The author has analysed 48 species of cleaned seeds belonging to the most widely differing families of cultivated plants: the determinations were made on the ash, which was treated twice with sulphuric acid, the persulphate colour-metric test being employed. The following amounts of manganese (in mgm. per 100 gm. of dried seeds) were thus obtained for the most typical plants: *Pinus sylvestris* (Scots Pine) 12.7 — *Phleum* (Cats'-tail Grass) 4.2 — *Alopecurus pratensis* (Fox-tail Grass) 11.6 — Oats 2.3 — *Festuca pratensis* (Meadow Fescue) 15.8 — *Poa pratensis* (Meadow-Grass) 5 — Italian ray-grass 4.5 — Wheat 2.8 — Barley 1.14 — Onion 1.2 — Hemp 3.45 — *Beta vulgaris* var. *crassa* (Common beet) 6.6; var. *ra*, 1.95 — Spinach 2.4 — Red Cabbage 6.5 — White Cabbage 2.45 — Turnip 2.1 — Crimson Clover 2.4 — White Clover 1.85 — Red Clover 2.5-2.7 — Lucerne 1.6 — Lupins 17.8 — Beans 1.5 — Peas 0.4 — Flax 10.2 — Celery 1.4 — Carrot 5.8 — Water-Melon 2.5 — Lettuce 2.4 — Chicory 1.7.

From the examination of these data as a whole, it is evident that seeds belonging to the most different families all contain manganese, and in most cases, in the proportion of 2 to 6 mgm per 100 gm. of dry seed. If the manganese content is estimated from the ash, it is in many cases about 50 mgm and generally a little below 100 mgm. The seeds of few varieties of plants contain a higher proportion of manganese; lupins must however be reckoned among the exceptions, as there are 1700 mgm. of this metal present in 100 gm. of ash. This figure is below the percentages given in scientific literature.

(1) See R. November 1921, No. 1007. (Ed.)

are for the ash of certain "manganese collectors": Oak wood 3.5 % in Birch wood 10-18 % — Beech leaves 9.50 % (in the form of the manganese-manganic oxide) — Lupin leaves 8.96 % (as manganese). If the data for the species of the same genera are compared, it will be seen, that they agree fairly well (see genera *Lolium*, *Allium*, *Brassica*, *Trifolium*, *Ficaria*, *Cucumis*). The similarity is however less evident in the genus *Festuca*, and in the genus *Beta* some of the most notable differences occur. If a comparison is made between the leaf data of plants which are sufficiently represented, such as the Festucaceae and Hordeaceae and the Sinapaceae, it will be found that the two first are clearly richer in manganese than the last although in the species of the same families, there are often considerable differences.

11 - **Experimental Researches on the Factors determining Resistance to Cooking in Leguminosae and on the Means employed to Remedy this Defect.** — De DOMINICIS, A. (Laboratorio di Chimica Agraria della R. Scuola Superiore di Agricoltura, Portici), in *Annali della R. Scuola Superiore di Agricoltura in Portici*, S. II, Vol. 16, p. 31. Portici, 1920.

From the dietetic point of view, the seeds of Leguminosae are described as being easy or difficult to cook according to the greater or less facility with which their consistency is altered by boiling in water. The causes determining this difference are not known, and no systematic attempt has been made to discover them. The question is certainly not one of hereditary character, but depends upon environmental conditions, reaction of which takes certain forms: it is therefore a peculiarity which can only be explained by these given conditions. The author has directed his attention to the causes determining this character and the results obtained are summarised as follows.

The hardness of leguminous seeds from the boiling standpoint depends upon their resistance to the action of water, whether this resistance is natural or artificially produced. The more water a seed can absorb, the more easily is it boiled, and the degree to which it is cooked depends upon the actual amount of water it has absorbed. Thus all the chemical and physical processes occurring during cooking are connected with the amount of the water taken up.

The water resistance of seeds cannot be correlated with any presupposed impermeable mineral deposits due to insoluble calcium combinations, for it can be overcome by alkalis, but not by acids, although the action of alkalis on the carbonate or silicate of calcium should be more energetic than that of alkalis.

Acids in fact increase this water resistance; oxalic acid has less effect however, than sulphuric and hydrochloric acid although it renders calcium compounds insoluble. This resistance cannot be attributed to the density of the integuments, because if this were lessened by the dissolving effect exerted by the alkalis upon certain given substances, acids should act in a similar manner, or else remain inactive, but in no case should they increase the impermeability of the tissues. Nor can it be regarded as connected

with the action of the ordinary ion present in hard waters upon the insoluble calcium compounds, for the seeds are equally resistant to soft waters, and the hypothesis of the existence of such mineral deposits has already been proved untenable; moreover salts other than those of calcium and acids themselves have the same effect. For the same reasons the other hypothesis postulating the formation of insoluble calcium compounds at the moment of cooking is equally fallacious. As this water resistance is not overcome by treatment with alcohol or ether, it cannot have any connection with excessively thick deposits of wax or other fatty substances that might possibly occur on the cuticle of the seeds.

The electrolytes penetrate into seeds in proportions different from those in which they are found in solutions, the ratio being larger with acids and alkalis and smaller with salts. Their penetration into seeds is therefore not a case of pure and simple diffusion, however the properties constituting the permeability of plant membranes may be interpreted. The variations produced by the concentration of the solutions upon the amount of the electrolytes incorporated by the seeds depend on the other hand upon a fundamental law governing the adsorption by solid, or colloidal adsorbent surfaces, *e. g.* the adsorption coefficient is not constant but increases as the concentration diminishes.

The substance constituting the seeds and exercising its adsorbent power upon the electrolytes belongs to one of those colloidal forms which arise from the concentration of the dispersive medium, and have the power of restoring it in a measure corresponding with their degree of reversibility. The swelling of the seeds in the presence of water thus consists essentially in a process of imbibition, as is proved by the contraction in volume relatively to the total volume of the seeds and of the absorbed water, the development of heat at the moment of absorption, the optic phenomena accompanying it, the selective power exercised towards liquids, and especially the effect of the electrolytes. The action that may be exerted by the integument and membranes in this connection is secondary and indirect.

The degree of the reversibility of these colloidal forms is connected with the conditions of the medium in which they have been formed and corresponds with the degree of their affinity to water. The hardness of the seeds is in strict correlation with this degree of affinity to water, although the extent to which it is influenced by the medium and the soil has yet to be determined. Experimentally however hardness is caused or increased in seeds by those special actions that intensify the non-reversibility of the gels, and should have no effect upon the above-mentioned chemical and morphological factors.

The electrolytes act by forming together with the substances of which the seeds are composed adsorption factors having a different affinity to water, or in simpler terms, having a different degree of solubility, solubility being understood in this case to mean the limit of concentration beyond which the substance in the dispersive medium is obliged to coagulate. Acids, acid salts and neutral salts act as coagulants and decrease this solubility; alkalis and alkaline compounds act in a dispersive manner and

crease it. Thus the alkaline compounds used in cooking decrease the water resistance of the seeds and facilitate the cooking process. At the moment of boiling however the alkalis attack the protein molecule and cause it to disintegrate which leads to the formation of amino-acids and the development of ammonia, sulphuretted hydrogen and carbonic acid. Hence there is a resultant loss of available nitrogen and a danger of the introduction of deleterious substances into the system if such food is eaten. This is a factor of the greatest importance in judging seeds that resist cooking, not only from the dietetic standpoint but also the economic and industrial. It is thus seen how very pernicious are the substances (carbonate of ash and bi-carbonate of soda), now used to remedy the defects of hard seeds due to their excessive water resistance.

1 - **A Contribution to the Determination of the Cause of the Formation of Bacteroids in the Nodules of Leguminosae.** — BARTHEL, C. (Bacteriological Laboratory of the Central Station of Agricultural Experiments at Experimentalfältet, near Stockholm), in *Annales de l'Institut Pasteur*, Vol. XXXV, No. 10, pp. 634-646 + figs. 6. Paris, October, 1921.

The experiments described in this work form part of a series of studies connected with the morphology and life-history of *Bacterium radicola* which have been carried on for several years in the Bacteriological Laboratory of the Central Station of Agricultural Experiments at Experimentalfältet in conjunction with the continuous preparation of cultures of bacteria for the inoculation of the different leguminosae grown by agriculturists.

The results obtained are summarised by the author as follows:

"Our experiments have proved the accuracy of ZIPFEL's statement that caffeine has the power of causing the constant formation of bacterioids in solid media. They have however also shown that this property is shared by other plant alkaloids of very different composition. Thus guanidine, uridine and chinoline all act in the same manner as caffeine, but to a less degree. It is very probable that other alkaloids behave in a similar way, as well as other nitrogenous organic compounds such as hippuric acid.

"As these plant alkaloids always enter into the composition of Leguminosae, it appears to be most likely, that the normal formation of bacterioids in the nodules of this family depends more or less upon the presence of alkaloids in the roots."

- **Instruction and Investigation in Plant Breeding at the College of Agriculture in the Philippines.** — MENDIOLA NEMESIO, B., in *The Philippine Agriculturist*, Vol. 10, No. 3, pp. 105-107, 1 fig. Los Baños, October, 1921.

PLANT
BREEDING

The above College of Agriculture offers 2 undergraduate courses and an advanced course in plant genetics. Each covers a period of six months.
First course: this consists of lectures and laboratory work and is modelled upon the first two undergraduate courses at Cornell University. It is aimed at giving students a fundamental understanding of the facts and laws underlying the phenomena of heredity and variation in their widest sense, and the relation of these phenomena to environment.

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Third course: elementary biometry.

The attention of the College of Agriculture has not been devoted only to instruction. Much practical work has been done in encouraging and carrying out experiments in selection and crossing, especially with rice, maize and sugar-cane which are among the most important crops of the Philippines.

- 154 - **Genetic Behaviour of the Spelt Form in Crosses between *Triticum Spelta* and *Triticum sativum*. The Possibility of obtaining Synthetic Forms of Wheat by Crosses between Two Spelts.** — LEIGHTY, C. E., and BOSHNAKIAN, S., in *Journal of Agricultural Research*, Vol. XXII, No. 7, pp. 335-364. Washington, November, 1921.

In the work described in this article 3 characters were taken into consideration: the shape of the glume, the brittleness of the rachis and the adherence of the grain. These characters are to a great extent linked.

THE OUTER GLUME OF *Triticum sativum*. — This is as a rule soft with a somewhat pointed apex and only occasionally weakly keeled along the entire length. About 0.5 to 1 mm. above the point of attachment there is a wrinkle or depression; the base is rather narrow and is very weakly attached to the rachis. In *T. spelta* on the other hand the glume is stiff and thick and has a very blunt apex. It is strongly keeled and has no depression above the base, which is wide and firmly attached to the rachis. Further in the spelt the rachis is brittle and the grains adhere firmly, whereas in wheat the rachis is much more tenacious and the grains are easily detached. These three characters, as stated above, are linked as if dependent on factors united in a single chromosome. The occurrence of crossovers, if it ever occurs, must be very rare.

In the 2nd and subsequent filial generations of *Spelta* × *sativum* there are many forms intermediate between the two parents.

In order to record the degree of inheritance of Spelt characters the authors have made an arbitrary scale of values ranging from 1 to 10, in which 1 represents typical spelt, and 10 typical wheat with no spelt characters.

The hybrids of the F_1 are slightly intermediate in form, but much more like the spelt than the *sativum* parent. They grade from 4 to 7 and have all the characters of a spelt, except that the spikelets are somewhat more open and the glumes are less adherent to the grain. In the F_2 the forms range from the typical wheat to the spelt, viz., from 1 to 10.

The frequency curve of these forms is of a special type, more individual being as a rule found at the extremities than near the centre as is seen from Table I.

As it is impossible to distinguish the homozygous spelts from the heterozygous, 2 groups only have been made in which all the spelt and speltoid forms are included (classes 1-9 inclusive).

TABLE I. — Number of Plants of the F_2 *Spelta* × *sativum* classed in 10 Categories.

	Crosses	Number of individuals in class										Total
		1	2	3	4	5	6	7	8	9	10	
255 ^a	<i>Spelt</i> sel. 13440 × Dale Gloria sel. 13401	17	10	9	5	4	1	3	1	2	21	73
260 ^a	<i>Spelt</i> sel. 13438 × Turkey sel. 13389	17	13	5	5	2	3	2	—	2	14	63
263 ^a	Dale Gloria sel. 13401 × <i>Spelt</i>	5	3	2	3	1	—	2	2	—	7	25
049 ^a	Black Bearded <i>Spelt</i> × Early Red Chief	19	7	5	—	3	4	3	5	6	29	81
085 ^a	Black Bearded <i>Spelt</i> × Jones Longberry	9	8	4	2	4	—	4	2	4	13	50
124 ^a	<i>Vulgare</i> (C. I. 3338) × <i>Spelt</i> sel. 13437	9	8	4	9	7	4	3	5	7	20	76
125 ^a	Crimean (C. I. 3340) sel. 13351 × <i>Spelt</i> sel. 13437	6	3	9	3	4	2	5	5	4	9	50

The proportions between *spelta* and *sativum* forms thus approximated the monohybrid ratio of 3 : 1. The proportion of homozygous forms heterozygous forms of spelt would therefore be 1 : 2 : 1, as is shown by the F_3 generation of 2 F_2 families, 13 260^a and 13 255^a (see Table II).

TABLE II. — Number of F_3 Plants from Series 13 260^a and 13 255^a which proved be Homozygous *Spelts*, Heterozygous forms and Homozygous *Wheats* (1 : 2 : 1) when tested in the F_3 Generation (1 : 2 : 1).

Nature of data	13260 ^a <i>Spelt</i> × Turkey				13255 ^a Dale Gloria × Turkey			
	Homozygous <i>Spelts</i>	Heterozygous	Homozygous <i>Wheats</i>	Total	Homozygous <i>Spelts</i>	Heterozygous	Homozygous <i>Wheats</i>	Total
aimed	8	13	9	30	7	14	12	33
culated.	7.5	15.0	7.5	—	8.2	16.5	8.2	—
iation.	0.5	0.0	1.5	—	1.2	2.5	3.8	—

The ratio 3 : 1 does not always occur. In the 2 families 13 126^a (Sant Square head × spelt) and 3019^a (Spelt × Salt Lake Club), for instance, the wheat types were very low (See Table III); in fact the proportion between the spelt forms and the wheat forms is better represented by the ratio 15 : 1 (See Table III).

On examining the F_3 generation of 27 F_2 plants, it was found, that 12 of these had produced only spelts, 2 plants yielded only *sativum* types, and the remaining 13 produced progeny of mixed forms.

TABLE III. — Degree of Spelling and Proportions of Spelts and Wheats Obtained in the F_2 Generations of *Spelta* \times *sativum* Crosses which did not segregate in the 3 : 1 Ratio.

Series	Degree of spelling in class										Total	Number of plants				Deviation	Probable error
	1	2	3	4	5	6	7	8	9	10		Obtained		Calculated			
												Spella	Sativum	Spella	Sativum		
1326*	12	7	7	6	9	8	3	6	12	4	74	70	4	69.4	4.6	0.6	1.49
3019*	27	15	9	7	3	5	2	5	8	2	83	81	2	77.8	5.2	3.2	1.49

We thus have the proportion, homozygous *Spelta* 7 : heterozygous form 8 : homozygous *sativum* 1, as it should be according to the proposed 15 : 1 ratio.

Assuming that the spelt parent in this particular cross carries two spelt factors S_2 and S_1 , the two first generations will consist of the following genotypic forms :

P_1 (Giant Squarehead)	$S_2S_1S_2S_2$	\times	$S_1S_1S_2S_2$	(Winter spelt)
<i>T. sativum</i>				<i>T. Spelta</i>
F_1	$S_1S_1S_2S_2$			
	(Speltoid)			
F_2 (1) $S_1S_1S_2S_2$	(1) $S_1S_1S_2S_2$	(4) $S_1S_1S_2S_2$	(2) $S_2S_1S_2S_2$	
	(2) $S_1S_1S_2S_2$		(2) $S_1S_1S_2S_2$	
	(1) $S_1S_1S_2S_2$			
	(2) $S_1S_1S_2S_2$			
	(1) $S_1S_1S_2S_2$			
Total: 1 <i>T. sativum</i>		15 <i>Spelta</i>		

In the F_3 the theoretical behaviour of each of the F_2 plants would be as follows :

Group	F_3 Genotypes	Phenotypes of the F_2 and their Behaviour in the F_3 .
A	(1) $S_1S_1S_2S_2$	1 <i>sativum</i> will yield <i>sativum</i> only
B	(1) $S_1S_1S_2S_2$	7 <i>Spelta</i> will yield <i>Spelta</i> only
	(2) $S_1S_1S_2S_2$	
	(2) $S_1S_1S_2S_2$	
	(1) $S_1S_1S_2S_2$	
C	(4) $S_1S_1S_2S_2$	4 <i>Spelta</i> will segregate in F_3 into <i>Spelta</i> : <i>sativum</i> in the ratio 15 : 1
D	(2) $S_1S_1S_2S_2$	4 <i>spelta</i> will segregate in the ratio 3 : 1.
	(2) $S_1S_1S_2S_2$	
		8 unstable forms

When the F_3 plants were examined a close approximation was found to the above-mentioned theoretical ratios, even as regards the genotypes which segregated in the 15 : 1, and the 3 : 1 ratios respectively.

In this connection it should be specially noticed that the same genotype of *Spelta*, when crossed with different varieties of *salvum*, can give two types of segregation 15 : 1 and 3 : 1. The authors try to account for this phenomenon by assuming that the spelt parent carried 2 spelt factors S_1 and S_2 and that some of the wheats used in the crosses carried an inhibiting factor I. In the presence of the latter factor, the ratio would be about 3 : 1, in its absence, the ratio would be 15 : 1.

Further the existence of determinants (modifiers) accentuating or attenuating the spelt characters has been clearly shown by the authors in the course of this work, thus explaining why heterozygous spelts of the S_8 type can produce very different frequency curves. Thus for instance plant 13 260^a-3 produced individuals mainly of classes 8 to 9, while plant 13 260^a-6 produced its spelts in classes 1 and 2 only; in the first case, there was a genetic factor attenuating the spelt character, and in the second a factor accentuating it. The presence of these factors, as may be readily understood, alters the Mendelian ratios between the *Spelta* and *saliva* forms and the combined effect of the factors accentuating and attenuating the *Spelta* character can produce some very complicated segregations.

PRODUCTION OF SYNTHETIC WHEATS BY CROSSING TWO SPELTIS AND OF SYNTHETIC SPELTIS BY CROSSING TWO WHEATS. — The authors have frequently obtained synthetic spelts in interspecific crosses in wheat. No indication has been observed as to the possibilities of producing true wheats in crosses between two different non-wheat cereals. It is theoretically possible, however, that such forms will be produced in crosses between certain kinds of spelts, as will be seen from the results of one of the experiments discussed in this paper. In the cross 13 126^a it was shown by the authors that 2 spelt factors S_1 and S_2 were involved and that there were present in the F_2 5 genotypic forms namely:

$$S_1S_1S_2S_2 - S_1s_1S_2S_2 - S_1S_1s_2s_2 - S_1s_1s_2s_2 - s_1s_2S_2S_2$$

As long as the forms are allowed to be selfed, as they are in nature, no *salivum* forms will ever appear, but in a number of crosses between these 5 forms, a certain proportion of wheat should occur in the following manner:

- 1) Crosses producing no wheats: $S_1S_1S_2S_2 \times$ any other genotype — $S_1s_1S_2S_2 \times s_1s_1S_2S_2 - S_1S_1s_2s_2 - S_1s_1s_2s_2$;
- 2) Cross where one out of every four F_2 plants will produce $6 \frac{1}{4} \%$ wheats: $S_1S_1S_2S_2 \times S_1s_1s_2s_2$;
- 3) Crosses where half of the F_1 plants produce $6 \frac{1}{4} \%$ wheats: $S_1S_1s_2s_2 \times S_1s_1S_2S_2 - S_1S_1S_2s_2 \times s_1s_1S_2S_2$;
- 4) Cross where all F_1 plants will produce $6 \frac{1}{4} \%$ wheats: $S_1S_1s_2s_2 \times s_1s_1S_2S_2$.

It is easy to understand how the wheat (*salivum*) character, being distinctly hypostatic, may be carried concealed from generation to generation

by the spelt type. How can the spelt type, which is so pronouncedly epistatic to the wheat character, be carried by a wheat without being manifested phenotypically? The explanation is simple. It was shown that modifying determinants are involved in these crosses. Common wheats occasionally carry modifiers which dilute the spelt character to the extent of grouping all the F_2 spelts into class 9. If these diluting factors are reduced to a homozygous dominant condition, they can well produce forms of spelt, identical or almost identical in appearance with wheat.

From a number of wheat \times wheat crosses (where one of the parents was a rust-resistant variety of winter-wheat and the other was Preston, Marquis, or Haynes Bluestem), over 20 spelts were found among the F_2 hybrid plants, though there were no spelts in the F_1 , their absence being due to an inhibition in the parent plant carrying the S factor.

These observations show that common wheats may carry the spelt factor, which is, however, unable to express itself because of the presence of one or more diluting or inhibiting factors.

The production of synthetic spelts in these *sativum* \times *sativum* crosses is similar to the synthetic production of *Triticum dicoccum dicoccoides*, the "Wild Wheat" of Palestine by the *vulgare* \times *durum* cross. The wild character, consisting of a number of interdependent specific characters, is strongly dominant over both the *vulgare* and the *durum* types just as the spelt type is dominant over *sativum*, yet in both instances, the character showing strong dominance towards either of the parental forms was carried by one of the parents together with a factor inhibiting in one case the "wild" and in the other, the spelt, characters.

155 - Variation and Correlation of Characters Among Rice Varieties Cultivated in the Philippines. — TORIBIO VIGAR, in *The Philippine Agriculturist*, Vol. X, No. 3, pp. 93-104, bibliography of 24 works. Los Baños, October 1921.

OBJECT OF THE WORK. — The investigation of which an account is given in this paper was conducted mainly as a basis for the selection of desirable varieties and to find answers to the following questions:

- 1) Are the late-maturing varieties heavy grain yielders?
- 2) Do tall varieties produce more grains than short?
- 3) Is there any relation between the length of the leaves, the length of the panicles, and the length of the grains on the one side, and the reproductive power of the plant on the other?
- 4) What relation have the width of the leaves, and the width of the grains to the productive power of varieties of rice?
- 5) Have the number of nodes and the number of spikes in the panicle anything to do with the grain yield?
- 6) Do tall varieties mature late?
- 7) Are varieties with long leaves, long panicles and long grains late in maturing?
- 8) Have the number of nodes and the number of spikes in the panicles any relation to the length of the growth period?
 - a) Have the width of the leaves and the width of the grains any relation to the growth period?
- 10) Is it true that varieties producing much straw require more time to mature?

[154-155]

The work was carried on during 1919-1920 in the rice-fields of the College of Agriculture and in those belonging to the Philippine Experiment Station farm.

MATERIALS AND METHOD. — For the study of variation and correlation 85 varieties were used: of these 16 are upland and 69 lowland — 30 awned and 55 awnless — 7 glutinous and 78 non-glutinous — 64 white — 1 black — 4 red — 15 mixed (of which some are undoubtedly hybrids).

TABLE I. — *Growth Period and Length of Culms.*

Growth period		Length of culms	
Days	Frequency	Centimetres	Frequency
100-120	3	80.00-96.66	21
121-140	21	96.67-113.33	20
141-160	21	113.34-130.00	25
161-180	22	130.01-146.67	13
181-200	16	146.68-163.34	3
201-220	2	163.35-180.01	3
Mean = 158.24 days		Mean = 98.72 cm.	

For the other values, it is sufficient to give the means — length of panicles = 22.50 cm.; number of spikes per panicle = 10.73; number of nodes per panicle = 8.11; width of broadest leaves 11.17 mm. — length of longest leaves 52.48 cm.; average width of 20 grains, 3.25 mm.; average length of 20 grains, 8.33 mm.; weight of straw per plant = 10.78 gm.

After giving the biometric data, the author considers the question of the coefficient of correlation between the most important characters. He obtained the results given in Table II, from which the following conclusions may be drawn:

- 1) The longer the time varieties of rice take to mature, the more grain they will yield.
- 2) Tall varieties produce more weight of grains than short.
- 3) Long leaves, long panicles and long grains are varietal qualities indicating high yielding power. These characters are also associated with the length of the growth period.
- 4) There is no correlation between yield and growth period on the one hand and length and width of grains on the other. There is no connection between yield, growth period and number of spikelets per panicle.
- 5) The number of nodes in the panicle is strongly associated with yield.
- 6) Varieties producing much straw are not necessarily heavy yielders, but they are generally late maturing.

Of the 19 pairs of characters studied in this investigation, 4 were included in JACOBSON'S work viz. growth period and yield of grains; length of culms and yield; length of grain and growth period; width of grain and growth period. The results obtained by the author substantiate those of JACOBSON in all respects but one. Width of grains and growth period were found by JACOBSON to be negatively correlated; in the author's work they were found to have no correlation at all.

TABLE II. — Coefficient of Correlation between the Most Important Characters.

Yield and growth period	0.5613 ± 0.0498
Yield and length of culm	0.4616 ± 0.0579
Yield and length of panicle	0.4704 ± 0.0566
Yield and number of nodes in the panicle	0.4977 ± 0.0547
Yield and number of spikes per panicle	0.1677 ± 0.0052
Yield and width of broadest leaves	0.1967 ± 0.0448
Yield and length of longest leaves	0.1547 ± 0.0554
Yield and width of grains	0.0591 ± 0.0474
Yield and length of grains	0.3233 ± 0.0651
Yield and weight of straw	0.1250 ± 0.0614
Growth period and length of culm	0.2050 ± 0.0421
Growth period and length of panicle	0.1270 ± 0.0611
Growth period and number of nodes in panicle	0.1094 ± 0.0640
Growth period and number of spikes per panicle	0.0431 ± 0.0592
Growth period and width of broadest leaves	0.2089 ± 0.0412
Growth period and length of longest leaves	0.9042 ± 0.0132
Growth period and width of grains	0.0602 ± 0.0467
Growth period and length of grains	0.2971 ± 0.0856
Growth period and weight of straw	0.5785 ± 0.0484

156 - Leaf-Tissue Production and Water Content in a Mutant Race of *Phaseolus vulgaris* as compared with the Parental Race. — HARRIS, A. J., in *The Botanical Gazette*, Vol. LXXII, No. 3, pp. 151-162. Chicago, Illinois, September 1921.

The objects of these investigations were to determine to what extent seedlings which are morphologically aberrant in the race to which they belong differ also from the normal seedlings in their physiological characters, in so far as these can be measured by the capacity for the production of tissue.

The author used as material a completely fixed teratological race of *Phaseolus* having the character of possessing 4 cotyledons. The tissues of this race (especially those of the primordial leaves) were compared with the tissues of the original line.

The biometric data fall into 3 groups:

- 1) a series of weighings of primordial leaves unclassified as to their number;
- 2) a series of weighings of primordial leaves classified with respect to their number;
- 3) a series of weighings of total epicotyledonary tissue.

Group 1. — The total weight of primordial leaf tissue in the abnormal seedlings is compared with the total weight in the control plants irrespective of the number of primordial leaves formed by the individual plants of the tetracotyledonous race. The total number of leaves per plant was determined separately and the following figures obtained for the 4 samples: $226 = 4.07$; $227 = 4.15$; $228 = 4.00$; $229 = 3.91$. The data are given in Table I.

TABLE I. — *Mean Green Weight per Plant and per Leaf.*

No of Plants	Per plant				Per leaf			
	Abnormal	Normal	Difference	Difference in %	Abnormal	Normal	Difference	Difference in %
226	0.6991	0.7516	— 0.0525	— 6.9 %	0.1718	0.3758	— 0.2040	— 54.2 %
227	0.6972	0.7607	— 0.0635	— 8.3	0.1680	0.3804	— 0.2124	— 55.2
228	0.6323	0.7568	— 0.1245	— 16.4	0.1542	0.3784	— 0.2242	— 59.2
229	0.7012	0.6862	+ 0.0150	+ 2.1	0.1793	0.3431	— 0.1638	— 47.7

The results show, that in 3 out of 4 cases, the green weight of the 4 primordial leaves of the tetracotyledonous race is lower than that of the 2 primordial leaves of the dictyledonous strain. The percentage differences range from +2.1 to —16.4 with a general average of —7.37. When the comparison is made on the basis of the mean weight per leaf, the primordial leaf of the abnormal seedling is found to be on the average 54.22 per cent lighter than the leaf of the normal seedling.

The percentage differences for dry weight of primordial leaves are less, varying from —1.6 to —18 % with a general average of —10.9 %. As regards the mean dry weight per leaf, the weight for tetracotyledonous plants was lower than for dicotyledons, the general average percentage difference being —55.92.

Group 2. — In order to make the comparative work more complete, the author made a minute examination of the relationships by considering individually the results obtained for abnormal seedlings with varying numbers of primordial leaves (2 to 7). The data show that: the difference between the total weight of primordial leaf tissue in the abnormal and the normal seedling decreases with the increase in the number of leaves in the abnormal plant, but the tetracotyledonous plants always produce a smaller total weight of leaf-tissue than the normal plants. The difference is greater when the comparison is made on the basis of dry weight. These data are summarised in Table II.

TABLE II. — *Differences in the Green Weight and Dry Weight of the Normal and the Abnormal Types.*

No of Plants	Difference of Green Weight	Difference of Dry Weight
2	— 31.55	— 32.55
3	— 20.74	— 25.54
4	— 11.97	— 16.34
5	— 8.60	— 13.78
6	— 3.10	— 7.93

Group 3. — The results obtained by a comparison of the total weight of tissue produced above the cotyledonary node confirm what has already

been ascertained as regards the primordial leaves alone. The green weight and the dry weight are highest in normal plants, the percentage differences ranging from -7.6 to -29.4 for the green weight, and from -10.1 to -30.5 for the dry weight.

Thus the mutant race is distinguished not merely by striking morphological differences, but by physiological differentiation as well.

157 - **Production of Varieties of Bean with Mottled Seeds.** — BLARINGHEM, L., in *Comptes rendus de l'Académie des Sciences*, Vol. 173, No. 10, pp. 666-668. Paris, October 1921.

In 1922 the author received from the Museum of Natural History 6 small, glossy, black seeds of *Vicia Faba* L. var. *pliniana*. These were sown at the Laboratory of Meudon (Seine et Oise), at the end of April, and produced 5 plants of uniform characters which bore seeds exactly similar to the sample. In the autumn of the same year, the author planted the seeds from a single plant of *V. Faba* var. *equina* taken from a crop of beans at Locon (Pas de Calais). The two lines were crossed on May 13; the pure-bred progeny when examined in 1913 and 1914 showed no variation from the original type.

The author attributes to crossing the variations described later.

The parent plants differed in many of their characters: *V. Faba equina* grows vigorously, producing 2-3 strong, grooved, hollow stems of equal length (120 cm.), 15 mm. in circumference at the base. The bunches of compact flowers give place to 3 to 6 smooth pods 10-12 cm. in length; each fruit contains 4-6 oblong seeds of average size (12 mm. \times 8 mm. \times 6 mm.), of a uniform light grey colour. *V. Faba pliniana* is a slender plant with one short main stem which is succeeded by late secondary shoot that are usually sterile. The stem is partially hollow, little grooved and measures 7 mm. at most round the base. It bears few flowers which grow two or three together and are succeeded by very small, pubescent pods with a slender tip. The fruits never exceed 5 cm. in length and generally contain 2 (never more than 4), black, oblong seeds of the size of a pea (6 mm. \times 4 mm. \times 3 mm.).

The crosses were made in the hope of obtaining xenia, but no sign of this phenomenon could be discovered. The cross-fertilisation (*pliniana* \times *equina*) of 3 flowers produced 2-1-0 seeds, and by the reciprocal cross (*equina* \times *pliniana*) also of 3 flowers, 3-1-1 seeds were obtained. The 8 seeds were sown in March 1914 and produced plants intermediate between the parents as regards length of stem and size of flowers and fruits. The stems were numerous and leafy, perhaps owing to the care taken in replanting the seedlings. The plants were gathered in August 1914 but could not be examined until August 1918: all the pods were hairy and had a curved beak; they contained 214 well-shaped, perfectly similar seeds. Their dull brown colour was no doubt more intense than when they ripened, for it has been found that bean seeds, whether green or yellow, become dark in the course of some years. When sown the following spring, these beans produced 92 plants whose progeny were followed until 1921.

In the second generation (F_2 — 1919) the segregation of the black-grey colour factors in the seeds appeared to take place regularly, since 30 *pliniana* \times *equina* seeds produced 7 hybrids with grey seeds and 23 brown or shaded seeds: 62 *equina* \times *pliniana* seeds produced 15 hybrids with grey seeds and 47 with brown seeds: the percentages of the grey recessives (23.5 and 24.3), being near the theoretical number, 25. The brown dominants were however not at all uniform, ranging from graduated shades of mottled grey to glossy black. Similarly 10 out of 47 of the *equina* \times *pliniana* hybrids were found to have a light ground mottled with yellow or brown. As a general rule the seeds borne by a single individual are alike: two plants of the F_2 however produced some pods in which the black seeds were in striking contrast to mottled seeds; an instance of segregation giving rise to a mosaic which the author has not since observed.

The proportion of plants with mottled seeds was far larger in the F_3 (1920). The 10 F_2 individuals with mottled seeds only produced seeds of this colouring; the 22 grey-seeded recessives produced 155 plants with grey seeds and 4 with mottled seeds, these individuals were no doubt the descendants of an F_2 plant with seeds but slightly mottled and hence passed over in 1919. In addition, a new character that had hitherto escaped the author's notice was clearly manifested in the progeny of some of the F_3 plants. This consisted in the presence of small brown dots on a grey background which were usually most numerous round the hilum and periphery of the seeds.

In the F_3 (1920), the relative proportions due to segregation in the brown hybrids (F_2) were as follows:

	Seed plants			
	grey	black	mottled	spotted
<i>pliniana</i> \times <i>equina</i> (23). . .	62	45	113	6
<i>equina</i> \times <i>pliniana</i> (47). . .	93	52	177	4

The 1921 (F_4) crops confirm these results, the progeny of the grey-seeded recessives all produced grey seeds with the exception of two lines in which there was a halo of brown spots surrounding the hilum. The plants resulting from the black seeds were rather weak and somewhat infertile. Half their seeds were black, the other half consisting of grey, black, mottled and spotted seeds in the proportions found in the F_3 . The spotted seeds of the F_3 chiefly produced plants with similar seeds; only 10% showed a throwback to grey or black colouring. Out of 28 plants grown from spotted seeds 13 bore spotted, 3 mottled, and 12 grey seeds.

On the other hand, a cross made at the end of June 1919 between late (F_2), individual of *pliniana* \times *equina* and a green-seeded *Vicia Faba* (Windsor bean), produced in 1920, shaded, intermediate, but flat beans, of which the 12 descendants in 1921 were composed of 2 recessives with

green seeds, 4 plants with brown seeds and 6 with mottled. It is remarkable that here again the proportion of mottled seeds exceeds that of the brown or grey-seeds.

To sum up: crosses effected between various divergent kinds of *Vicia Faba* show that in seeds brown is dominant to grey or green. The *pliniana* line imparts to the hybrids (after the second generation), the new characters of mottles or spots, which persist in a good many of the progeny and appear even more fixed than the brown character of the parent. There are many fixed varieties of *Phaseolus* characterised by mottling, spots or shaded areas round the hilum, so no doubt similar varieties of *Vicia Faba* could also be obtained, if there were any market demand for them.

158 -- Cotton Selection: Method Adopted in Egypt by the Sultanic Agricultural Society (1). — FREEMAN GEO. F., in *Sultanic Agricultural Society, Technical Section Bulletin* No. 3, pp. 1-16. Cairo, 1920.

The chief types of cotton, such as American Short Staple, Indian Short Staple and Sea Island, have in all probability their origin in conscious or unconscious selection from different wild species. The several varieties within these types have originated from sports, mutations or hybrids that have been grown in separate cultures or have gained ascendancy through local climatic selection.

Since however crossing takes place freely between the different types within a species, very few commercial varieties are even approximately pure. When to this is added the mechanical mixing of seeds that occurs at the ginning plants and store-houses or through volunteer cotton in the field, it is easy to realise the difficulty of the task of the cotton selector whose object is not only to discover or produce high yielding varieties of desirable quality, but also to secure and maintain uniformity in his product.

SELECTION OF ORIGINAL MOTHER PLANTS. — a) *Material*. — At least two or three acres are planted with the best available seed of the variety to be improved in such a manner as to facilitate the observation of the individual plants.

b) *Selection Based on Vegetative Characters*. — The type that is to be the object of selection is first determined. For this purpose a set of arbitrary standards is chosen for each of the characters (shape of boll, height of plant, branches, etc.), in order to serve as a basis of comparison.

A thousand or more plants which are true to the type of the variety in all characters considered must be examined. Each plant is given a serial number and its description is written on a printed blank. That used in 1919 was as follows:

(1) See Orig. Article of W. L. BAILS, "Studies on the Cotton Plant of Egypt," in *S.* Aug. 1915, No. 1096. (Ed.)

COTTON — Description of Selected Plant.

Locality Date
 Variety Plant No.
 Diameter of space occupied dem.
 Height dem.
 Habit: open — shut — dwarf — bushy.
 Leaves: large — medium — small.
 Vegetative Branches: Number.
 Bolls: Size — large — medium — small.
 Boll: Number Shape No.

Locules	2	3	4	5

Seed Cotton: Total weight weight per boll
 weight of seed % lint
 weight of lint weight of 100 seeds
 Lint index
 Notes Length of lint
 Seeds per boll

c) *Selection Based on Provisional Estimate of Lint Length and Strength.* — The length and strength of the lint are roughly estimated in the field. If the lint from apparently normal bolls is weak or too short the plant is at once rejected.

d) *Selection Based on Laboratory Studies.* — The laboratory studies are based upon the different picking of the same plant put together, and are carried out in the following order.

1) A choice is made of seeds for microscopic or physical studies: the material is divided into 10 lots, from each of which is taken at random one sound locule; the middle seed is removed, great care being taken to separate it with its own lint.

2) The cotton seed is weighed (excluding the sample of 10 reserved seeds).

3) The seed is ginned and the seed and lint are put into separate pockets of the bag.

4) The samples of lint are submitted to a cotton expert to distinguish the three classes "bad", "typical", "superior". All the samples classified as bad are discarded.

5) The lint is weighed and its % calculated.

6) The representative sample of seeds is weighed and the lint index calculated by the following formula:

$$\frac{\% \text{ lint} \times \text{weight of 100 seeds} \times 100}{\% \text{ seeds}} = \text{lint index}$$

(It is convenient to use tables previously prepared).

7) The seeds of the plants classified as "typical" or "superior" are selected on the basis of lint characters and which have shown themselves typical in morpho-

logical characters are then studied as regards: amount and colour of the fuzz, the shape and colour of the seed etc. It is best to use for comparison type samples placed in series and referred to by number thus: fuzz color 6; fuzz distribution 4; beak 5; shape 8; seed-coat markings 3; seed-coat colour 5. The range of the type of the variety in each of these characters having been determined, any plant falling outside the variety type-group should be discarded.

8) The seeds of those plants which are true to the type of the variety and are classed as excellent by the expert and also show agricultural promise (earliness, good yield, etc.), are retained for planting in pedigree plant plots the following year. The ten seeds reserved from these plants are subjected to careful laboratory studies; 1) measurements of the lint length by combing and measuring the circumference of the lint halo, in special cases, the measures of individual fibres are also taken. Breaking strength and elasticity are determined on 100 fibres from each plant — 3) the relative fibre diameter and twist are determined microscopically on 20 fibres. These characters are all recorded and kept for comparison with the offspring of the selected mother plants grown in the pedigree plant plots the following year.

PEDIGREE PLANT PLOTS. — *First year:* the seeds of each mother plant are sown separately in the pedigree plots. When the plants are well established they may be thinned to one plant in the hill. During the blooming season, all the fresh flowers in each of the plant plots are counted daily; the data thus obtained shows the earliness of the strain. Throughout the growing season, each plot is studied with regard to its uniformity in vegetative types and to all characters indicative of its agricultural value, special attention being paid to: the number and position of the vegetative branches; the number and position of the flowers; the length and number of the nodes of the fruiting branches; the type and quantity of the leaves size and shape of the bolls; the number of locules; and the manner of opening of the bolls.

As the plants develop and begin to bloom, all "off type" plants should be pulled up, the reason for their destruction being given in the records of the plot.

When the first bolls open, the plant plots must be examined carefully, and those having bad vegetative characters, or few bolls per plant, or shewing late development should be rejected. From each of the remaining plots a representative sample should be picked on which are recorded lint length, weight of lint per boll, lint index and seed weight. All plots below the average in these respects are at once rejected.

From the remaining plots the plants are picked separately at harvest time. The final height-number of vegetative branches; boll-shape number; number of bolls opening; average weight of seed cotton per boll; percentage of lint; weight of 100 seeds; lint index; lint length and quality of lint, as judged by the expert, are recorded for each plant.

These data are then assembled to show the distribution and average value of the different vegetative characters for the plants of each plot.

These distribution curves may then be compared with the corresponding characters of the parent plants in order to ascertain the parental stocks which were able to transmit their special characters in a high degree and average to the population of their offspring.

After the completion of these studies, the most promising individual plants of the superior plots are retained for sowing in plant plots the following year.

Second year. — The plant plots are sown, treated and studied exactly as in the first year; all plots that do not maintain the high standard exhibited the first year are eliminated.

In order to secure pure close-fertilised seed from the most promising plots, bags are used. These were made by the author from mosquito netting and do not hinder the respiration or transpiration of the flower as is the case with bags of paper or muslin: A piece of netting 5 by 6 inches is required for each, this is folded and sown up, so as to form a bag 3 by 5 inches; at the open end is attached a piece of thin copper wire about 4 or 5 inches long which keeps the bag in position, being twisted two or three times round the pedicel. The bag may be put on as soon as the pedicel is long enough to allow the bag to be closed beneath the bracteoles.

The exact size of the bag (which varies according to the variety of cotton-plant), must be such as to allow the petals to develop normally, but not to unroll completely. The petals thus form a loose envelope enclosing and protecting the stamens and pistils so that self fertilisation is insured.

Third year. — The close pollinated seed from the most promising individual plants and the superior plots of the second year are again sown and studied in the same manner, all off-type or inferior plants or unsatisfactory plots being discarded. The seed of each plot remaining after this eliminating process, is collected together, and kept for planting the following year in *pedigree increase plots*.

PEDIGREE INCREASE PLOTS. — *First year.* — These must be carefully watched in order to eliminate all off-type or inferior plants. The study of the agricultural, vegetative and lint characters is made as before, but owing to the large number of plants, a certain number only forming a representative sample, are examined. At the end of the season the less promising plots are rejected and the seed of the very best is sown in the larger pedigree increase plots of the next year.

Second year. — The same operations are carried out as in the first year. At the end of the season, a further selection is made whereby only the strains which have passed all the 6 elimination tests are retained. The seeds of these strains will by this time have multiplied to such an extent as to admit of planting in large scale increase fields.

In short, the operations may be grouped under the following headings:

- 1) Selection of original mother plants
- 2) Pedigree plant plots: First year
- 3) Pedigree plant plots: Second year
- 4) Pedigree plant plots: Third year

- 5) Pedigree increase plots: First year
- 6) Pedigree increase plots: Second year
- 7) Pedigree fields.

The plan is thus designed to give a continuous supply of seed pure to type and never more than 6 years removed from a single selected mother plant. If artificial hybridisation becomes desirable, the F_2 plants will serve as the starting point for plant selection in the same manner as has been above described for field selection. Here selection is made by keeping in mind the combination of characters desired in the new type.

159 — Varietal Trials with Spring Wheat in North Dakota, U. S. Comparative Grain Yields and Milling and Baking Qualities. — STOA, T. E., in *Bulletin* 149, Agricultural Experiment Station, North Dakota Agricultural College, pp. 1-55, table XXXIII, figs 4. Aug. 1921.

The average acreage cropped with wheat in North Dakota for the 10 years period 1910-19 was 7 767 500 acres, and the average acre yield during that period was 10.5 bushels.

Varietal trials have been conducted at 7 Experiment Stations in this State. The average annual precipitation at these Stations ranges from 13.77 in. at Hettinger (S. W.) to 23.62 in. at Fargo (S. E.) and the average seasonal precipitation (April to July inclusive) ranges from 8.05 inches at Hettinger and 8.12 in. at Langdon (N E) to 12.67 in. at Fargo.

GRAIN YIELDS. — Comparative data on grain yields for the two main classes of wheat, namely, common (*Triticum vulgare*) and durum (*T. durum*) are given with reference to the several Sub-stations concerned. The class and group separations employed are as follows:—

1) *T. vulgare*: Fife Group. — Red Fife, Power, Glyndon, Marquis, Ghirka Spring, Kitchener, Ruby, Red Bobs; Bluestem Group. — Haynes, Dakota; Preston Group. Preston Pioneer, Kota, Miscellaneous. Prelude, Humpback.

2) *T. durum*: Amber Durum Group. Kubanka, Arnautka, Monad, Acme, Mindum, Kahla, Peliss, Golden Ball. Red Durum Group, D. 5 (Durum No. 5), No. 58 (C. I., No. 5618).

Of the *T. vulgare*, Marquis is distinctly superior to all other commercial varieties, for the Eastern and Southern sections of the State. In the central and south-western sections, Power gave a slightly superior yield, but the difference between the two is negligible. Stem rust (*Puccinia graminis*, has been less frequent in the western than in the eastern sections.

A comparison is made between the average yields (in bushels per acre) of the best varieties of *T. vulgare* grown at each station from 1913 to 1920, for 3, 4, 5, 7 and 8-year periods respectively. Taking for example the results for the 7-year period in the S. E. and N. W. the two outstanding varieties, Marquis and Power (Fife group), gave for the 7-year period in the S. E. area (Fargo), 21.7 and 18.8 bus. per acre respectively and in the N. W. area (Williston), 27.2 and 27.9 bus. respectively. Of the Bluestem group for a similar period in the S. E. Dakota and Haynes both gave 15.5 bus. per acre and in N. W. 26.8 and 25.5 bus. respectively. Of the Preston group

the var. Preston gave for a similar period 18.5 bus. (S. E.) and 26.6 bus. (N. W.).

A similar comparison is made between the average yields for the varieties of *T. durum* grown at each station and for similar periods. For comparative purposes the 7-year period S. E. and N. W. have here been selected.

The Kubanka gave 24.7 bus. per acre (S. E.) and 28.6 bus. (N. W.). Amautka, 20.2 bus. (S. E.) and 28.8 (N. W.). The Monad and Acme have not been grown as long. The data available for them, however, in comparison with the other varieties, are interesting and conclusive, e. g. at Fargo (S. E.) in 4 years, Monad gave a superior yield to Kubanka by 3.5 bus. per acre and at Williston (N. W.) after 3 years the superior yield amounted to 3.6 bus.

In 1913, 13 % of the wheat acreage in N. Dakota was cropped with durum wheat and in 1920 this rose to 36 %; it is estimated that in 1921, about 45 % of the acreage will be devoted to durum.

Stem rust infection. — Comparative estimates are given in tabular form of the percentage stem rust infection for the principal varieties named and these indicate that of the common wheats Marquis, although not resistant, being an early wheat other things being equal, is thereby helped to escape rust attack to a large extent. Other varieties such as Power, Haynes and Preston are very susceptible to rust, but the Kota var. (Preston group) appeared to be comparatively resistant. The durum wheats are apparently, taken as a whole, more resistant both to rust and also to drought. Monad and Acme show up well in this respect and D. 5 was the least susceptible of any of the varieties named.

Observations relative to the susceptibility of varieties have been made at Fargo and Dickinson over a series of years. Taking first the S. E. section for a 7-year period, the average percentage of infection is estimated as follows: (Common) Power 49.7 to 58.4, Marquis 38.3, Dakota 49.0, Preston 47.1. (Durum) Kubanka 30.1, Amautka 34.7, Kahla 23.7, Ghar-novka 26.3. For a 3-year period Nomad showed only 1.3 % infection and Acme 2.0 %; taking next the S. W. section, a 3-years average gave: (Common) Power 24.1, Red Fife 22.8, Marquis 23.2, Haynes 24.6, Preston 29.0, Pioneer 17.6: (Durum): Kubanka 10.7, Kubanka No. 8, 12.5.

Full details are given in the tables of the infection percentage for each individual year.

MATURITY REQUIREMENTS. — On an average for 7 years (1913-20), at Fargo (S. E.), Marquis matured in 87.8 days, Preston 88.5, Power 91, Dakota 92.5, and Kubanka 91.7. Other data are also given.

HEIGHT OF PLANTS. — There did not appear to be much variation in height. Taking the 2-year period (1918-20) as an example, in the Fife group, the height ranged from 37 inches Power, to 40.5 Kitchener, in the Bluestem the range was from 38.5 to 40.5, in Preston, 39.5, and for the Amber durums, 41.0 to 41.4 in. Full details are given in tabular form comparing some agronomic characters for established and promising new varieties of wheat in the S. E. and S. W. areas.

STRAW YIELDS. — Durum wheats in general produce longer, and thus

more straw than the common wheats. At Fargo, Kubanka has yielded more straw on an average than any of the other established varieties. Marquis did not produce as much straw as Power or Dakota, but more than Preston. All straw yields were less in the S. W. section than in the S. E., this was especially noticeable in the case of Marquis which gave exceptionally light yields. However, the low rainfall in the S. W. area has frequently been a big factor in preventing the normal development of plants. Taking the yields as a whole, with the common wheats, the Fife group gave on an average for a 6-year period, 3475 lb. (Marquis) to 3734 lb. (Power); Bluestem group, 3596 to 3974 lb; Preston 3304 lb. and with the durum wheats, 3747 and 3748 lb. for Kubanka and Arnautka respectively.

Tables are given of data with regard to the yields per acre for the various years.

WEIGHT PER BUSHEL. — It does not necessarily follow that a high bushel weight alone, means a high quality of wheat, or wheat of high milling and baking value. According to the appended table, the average weight per bus. in lb. varies from 51.5 to 56.9 lb. for the Fife, Bluestem and Preston groups, and amounts to 59.4 lb. for var. Prelude. For the durum wheats, the average weight is evidently higher and varies from 59.3 to 61 lb. (In both the above-mentioned cases the data here refer to the S. W. Section and a 1-year period).

MILLING AND BAKING QUALITIES. — In this connection observations have been made at Fargo (S. E.) since 1917 and at Dickinson (S. W.) since 1911. The data given in the present publication include the comparative yearly percentage of straight flour from the principal varieties; the amount of water the flour absorbs, or requires, to make dough of proper consistency; the volume of the loaf baked from the flour, and averages showing the rating as regards colour and texture of the loaves. Flour from Marquis is apparently superior to that from other commercial varieties for bread-making purposes. Durum wheat flour does not appear to have the strength of gluten associated with flour from common wheats. Of the commercial amber-durum varieties, Kubanka is superior to Arnautka. Monad, a variety of more recent origin, and Acme are distinctly superior to Kubanka as regards yield but its flour gives a smaller loaf. The D-5, red durum, yields well; its milling and baking qualities are, however, distinctly of inferior quality, and do not satisfy the requirements of either the bread or macaroni trade.

160 - **The Composition of Wheat Affected by Meteorological Conditions** — SHUTT, E. T. (Chemist for the Dominion of Canada), Report of the Chemist, in *Rapport des Fermes Expérimentales du Dominion*, Fiscal Year ending March 31, 1920, p. 59. Ottawa 1921.

This study which was begun in 1908, shows that climatic and seasonal conditions not only affect the wheat yield, but may also exert a powerful influence upon the protein content of the grain. Wheat from the same parent stock was sown at the various experiment farm and Stations, and careful observations and records were made of the crops obtained, and the temperature during the growth period. One sample of wheat from each

plot is analysed, and the data are incorporated in the form of tables, in the meteorological statistics.

On account of the War the analysis of the wheat samples had been interrupted since 1916, but has now been resumed and the results will be correlated with the temperature statistics, in order to see the influence of environment upon growth, composition and yield. The first results obtained by this method of research have shown that the conditions favourable to the formation of the hard kernel, rich in gluten, characterising wheat of good quality, are a relatively dry soil, and the prevalence of a relatively high temperature during the time that the grain is filling out and ripening.

161 - **Satisfactory Results obtained in Italy with a Variety of Rice from the United States.** — NOVELLI, N., in *Giornale di Riscicoltura*, Vol. XI, No. 12, p. 181-183. Vercelli, December, 1921.

The "R. Stazione sperimentale di Riscicoltura" of Vercelli has imported from the United States 2 varieties of rice called American 1561 and American 1600. As the grain of both is good and the varieties were said to be very productive, trial crops were grown not only at the Station itself but on several agricultural farms and by many competent farmers in various parts of Piedmont, Lombardy and Emilia.

American 1561 never ripened; while American 1600 proved similar in development and vegetative growth to the Italian variety "originario," although perhaps it produces less straw. Average height 1.45 m.; tillering average; 15-18 culms; a little more resistant to lodging than "originario" owing to its rather slender flexible stem with many vascular bundles, and its more compact panicle; ripens at the same date as "originario," or perhaps a little earlier; ears denser with an average length of 20 cm., each bearing 160-180 kernels; production generally good, being about 60 quintals of paddy per hectare (one agriculturist obtained over 70 quintals); grain similar to that of "originario," glumes very thin and lighter in colour. This variety does best on slightly clayey soil.

The author is of opinion that it is worth breeding, and the seed section of the Vercelli "Stazione di Riscicoltura" has already taken the work in hand.

162 - **Gembok Beans (*Bauhinia Esculenta*) from South Africa.** — *Bulletin of the Imperial Institute*, Vol. XIX, No. 2, pp. 142-144. London, 1921.

The seeds of the leguminous plant *Bauhinia esculenta* have been examined recently at the Imperial Institute, at the request of the Chief Division of Botany, Union of South Africa. It was stated that the seeds, which are known locally as "Gembok beans" are utilised in the South-West Protectorate both for native consumption and for feeding animals, and it was desired to ascertain their precise food value and whether they contain any injurious substance.

The seeds were dark reddish-brown in colour, about $\frac{1}{2}$ to $\frac{5}{8}$ inches

in diameter, with woody shells, 49 %, and oily kernels 51 %, cream-coloured with a pleasant, nutty but slightly bitter flavour.

The kernels contained 4 % of moisture; on extraction with ether the yield was 41.6 % of a golden-yellow limpid oil, equivalent to 43.3 % from moisture free kernels.

The appended Table shows the composition of the kernels, shells, entire seeds, residual meal (containing 7 % fat) compared with that of decorticated cotton-seed cake.

	<i>Bauhinia esculenta</i>				Decorticated cotton-seed cake
	Kernels	Shells	Entire seeds	Meal	
Moisture	4.0 %	8.5 %	6.2 %	6.4 %	8.65 %
Crude protein	32.8	2.5	18.0	52.2	40.25
Fat	11.6	0.2	21.3	7.0	7.93
Carbohydrates (by difference) . .	17.2	67.2	41.6	27.4	26.06
Crude fibre	1.3	19.8	10.4	2.1	10.16
Ash	3.1	1.8	2.5	4.9	6.95
Nutrient ratio	1 : 3.4	1 : 27.1	1 : 5.0	1 : 08.3	1 : 1.1
Food units	203	74	140	175	147

The oil extracted, which has a pleasant odour and taste, possessed the following characteristics, compared with cotton seed oil (given in brackets) :—

Specific gravity 0.9211 (0.922-0.925); refractive index at 40° C, 1.464; solidifying point of fatty acids, 30.6° C (35°-38°); acid value 0.6; saponification value 190.0 (192-195); iodine value 95.6 % (105-115 %); unsaponifiable matter 0.8 % (0.8-1.8 %), volatile acids, soluble 0.3; insoluble 0.1.

The results show that the kernels of *B. esculenta* are rich in protein and oil, and that the oil resembles cotton-seed oil. The meal contains a high percentage of protein but a poor fibre content, and in these respects is superior to decorticated cotton-seed cake.

No injurious substance was found in the seeds, but it has not been definitely established that they are harmless: it is considered advisable therefore to carry out feeding trials before definitely recommending the beans for general use as a feed. For this purpose, the hard shells should be removed, as they are woody and of low food value.

Up to the present no information appears to be available regarding the composition of Gembok seeds and their use as a feeding stuff, but the seeds of certain species of *Bauhinia* are stated to be employed as a feed in India.

If available in sufficient quantities, these seeds seem likely to be of distinct value both as foodstuffs and for oil extraction.

103 - **Development of Potato Tubers. Experiments Made in Colorado, U. S. A. —**
 CLARK, C. F. (Office of Horticultural and Pomological Investigations) in *Bulletin No. 958, United States Department of Agriculture*, pp. 1-27, figs. 10, tables 11, Bibliography of 12 works. Washington, D. C., Aug. 22, 1921.

STARCH CROPS

The experiments here described were carried out at the Colorado Potato Experiment Station, Greeley, during the seasons 1916-18. A few minor observations were also made in Maine in 1919 for the purpose of verifying previous conclusions as to the time of the beginning of tuber formation. While these studies could profitably be extended to cover a longer period and include a greater number of varieties and a wider range of environmental conditions, the author considers it advisable to place on record the results obtained up to the present time.

The material used for the experimental work was grown under field conditions, the cultural operations following those in general use in the locality. The minimum size of tuber saved was $\frac{1}{2}$ inch. When a separation was made into marketable potatoes and culls, the division was by weight, the former including those equal to or exceeding 3 ounces and the culls those below this limit.

The statistical studies of tubers at one-week intervals showed that the greater part of those which grew to exceed $\frac{1}{2}$ inch in diameter were formed at the start of tuber development. The maximum rate of growth of tubers was found to occur at the end of August or beginning of September, approximately 80 days after planting. At this time nearly $\frac{1}{3}$ of the total period of tuber development had been completed. The differences in the sizes of the tubers in the individual hills may be attributed largely to the unequal rate of growth rather than to the differences in the age of the tubers. A small increase in the weight of tubers was found to occur after the vines had been killed by frost.

The weight of the tuber did not appear to be correlated with the length of the stolon upon which it is produced. The average data show a tendency towards a decrease in the size of the tuber on the upper stolons, though the individual plants showed considerable diversity in this respect. The greatest average weight was produced by the lowest stolons in the 2-stolon and 3-stolon groups; while in the 4-stolon group the maximum production was in the second position, with a gradual decrease in the weight in the upper stolons. Larger numbers of observations are however needed to establish the laws governing these relationships.

The number and weights of tubers per hill were found to be influenced by the size and kind of sett planted. The relative influence of whole and cut setts on tuber production using the Rural New Yorker variety of potatoes has been determined and it appears, according to the data given, that a slightly larger number and with one exception a larger weight of tubers per stem was obtained when whole setts were used.

The fact that the tuber producing ability of different varieties varies considerably with respect to the number and weight of tubers per hills brought out very clearly in the diagrams showing the number and weight of tubers per hill produced in 500 hills of Rural New Yorker (average

4.5 and 860.7 gm. respectively) and 500 hills of Pearl (average 6.9 and 944 gm. respectively). A further comparison of the behaviour of different varieties under varying treatment with respect to irrigation was made. (The varieties tested were Triumph, Early Ohio, Charles Downing, Russet, Burbank, Peachblow, Late Ohio, in addition to the two varieties above mentioned. The number of tubers per hill ranged from 3.8 in Rural New Yorker to 7.1 Charles Downing. The lowest average weights per hill were produced by the two early varieties, Triumph and Early Ohio, the highest by the late variety, Pearl. Apparently the application of water before tuber formation had begun, increased the number of tubers. Increasing the number of irrigations appears to have had little effect on the number of tubers; the weight per hill was however increased by each additional irrigation except where the applications were too frequent.

The experiments on different types of soil revealed the existence of a close relationship between the character of the soil and the number and weight of tubers. Fine sandy loams invariably gave the best results, the number of tubers per hill (Rural New Yorker var.) being 6.3 and weight of tubers per hill 1033.5 gm. (average 162.8) compared with clay loam, 4.9, 663.7 gm. (average 136.5) and heavy clay 3.0, 376.7 gm. (average 125.3) respectively.

164 - **The Barajillo (*Meibomia Rensoni*), a Good Leguminous Forage Plant, Indigenous in Central America** (1). — RENSON, C., in *Revista de Agricultura Tropical, Órgano de la Dirección general de Agricultura e Industria, República de El Salvador*, Vol. I, No. 2, pp. 65-77, 8 figs. San Salvador, February 1, 1921.

The barajillo, which is also called "Juana larga", "vara de arco", "arquillo", etc., is a Leguminosa belonging to the group of the Hedy-saraceae. It has been identified by PAYNTER (of the Bureau of Plant Industry of the United States Department of Agriculture), as *Meibomia Rensoni* n. sp., and grows wild in Central America at altitudes of between 600 and 1200 m. in places that are not frequented by livestock, for horses, mules and cattle eat it with such avidity that they end in entirely destroying the plant. When left undisturbed and allowed to grow freely, *Meibomia Rensoni* forms a small tree 5 to 6 metres in height, with slender, unbranched trunk terminating in a heavy bushy crown which makes the stem bend in a bow.

The fruit is a lomentum that easily breaks across at the joints; the latter are hard and contain a single seed.

If these pieces of the lomentum are planted in ploughed land, the seeds do not germinate; this fact has been stated by many agriculturists, and was proved by the author's experiments. The small seeds must be removed from the pod without injury and, according to the author, this is best done by placing the seeds on a plate of rubber and running

(1) For *Desmodium leiocarpum* G. Don (= *Meibomia leiocarpa* = *Hedysarum leiocarpum* Spreng = *Hedysarum erectum* Vell.) as a forage plant in Cuba, see R. December, 1921, No. 1097. (Ed.)

rubber-roller over them. After the ground is ploughed, it should be harrowed and rolled; the seeds (mixed with soil) must be sown broadcast and not covered with earth. They germinate in about 12 days, and the plants grow so rapidly that in 5 months their height exceeds that of man.

The author advises a wide growth of this excellent forage plant in Central America, for the only artificial meadows in that country are "zarcuales" composed of Graminae, and the need of a forage leguminosa all the more keenly felt, because only negative results have been obtained with the foreign species hitherto tested.

55 - **Florida Beggar Weed (*Desmodium Tortuosum*)** (1). — MUNDY, H. G., in *The Rhodesia Agricultural Journal*, Vol. XVIII, No. 5, pp. 504-505, pl. 1. Salisbury, October 1921.

For many years, Florida beggar weed (*Desmodium tortuosum*) has given excellent results on the Experiment Station at Salisbury with or without irrigation, and without any special soil treatment. During the season 1920-21 one plot of beggar weed sown in January 1920, was cut as follows:

1st cutting (Oct. 6), height 12 inches, 2nd cutting (Nov. 20), height 8 inches, 3rd cutting (Dec. 30), height 21 inches, 4th cutting (Feb. 16), height 21 inches, 5th cutting (March 20), height 18 inches, 6th cutting (June 8), height 9 inches.

Growth on the earliest cutting was hastened by irrigation (one watering in September). A second watering was given on October 10, after which the crop was entirely dependent upon rainfall. The 6th cutting yielded 1170 lb. of green fodder per acre, and since this was the shortest growth of any, it may be safely assumed that the total yield of green forage per acre for the 6 cuttings was not less than 12 000 lb.

Further reports from other districts of Rhodesia bear out the opinion already formed of this crop.

The stalks of *D. tortuosum*, as they mature, become hard and woody and it is therefore recommended to cut or graze frequently and before it becomes too mature. The seed germinated easily, and is extremely hardy when young, very few plants burning or wilting even during drought.

Although this crop cannot be reckoned as equal in quality, where clover cannot be grown without great difficulty, beggar weed has been shown to be the next best substitute.

16 - **Method for calculating the Production of Pastures.** — See No. 183 of this Review.

17 - **Piedmont Hemp.** — DOLCI, E., in *La France et le Marché italien, Organe de la Chambre de Commerce Italienne à Paris*, Year XXXVI, Nos. 245-247, pp. 291-293, figs. 2. Paris, July-September 1921.

Report of Prof. Ermanno DOLCI, Technical Delegate for the Industrial and Agricultural Development of Piedmont hemp.

FIBRE CROPS

(1) For nitrogen content of *D. tortuosum*, see K. Dec. 1917, No. 1126. (Ed.)

Italian hemp has long been imported into France, and the quotation of the Bologna and Naples hemp markets are given on the Stock Exchange of Paris and Marseilles. The author does not speak of the classic variety of Campania and Emilia but deals solely with Piedmont hemp (*Cannab. sativa* var. *excelsior*).

The seed of this variety has for many years been imported from Carmagnola into the hemp-growing regions of Anjou and Touraine, especially into the district between Saumur and Daguenère. The seeds are sown very far apart and produce large-branched plants from which the fibre known as "fils du Piémont" is obtained. This variety is sown in the fields where rope-making hemp is cultivated, and its fibre is called "petit fils du Piémont." It is this selected seed that is bought by the growers of Basse-Loire and provides the hems for spinning, known as "chanvre pour filature".

It may be said that the Piedmont hemp seed has now acquired a world-wide reputation. Its biological characters are well-known and have been the subject of careful experiment in France, Serbia, Russia and America owing to a great extent to the initiative of the "Cassa Rurale Villanova Solaro" (Cuneo), which has its Head Office at 22 Via Balbo, Turin.

Some large French string-factories (for instance that at Mâcon) prefer the Piedmont tow to the classical product of Emilia, and also to the Neapolitan variety, for though less pliable it is not at all woody on account of the special hand-treatment it receives. The worker seizes the base of the stalk to be decorticated, removes the cortex covering the root, and breaking the stalk into two or three pieces, then detaches it from the tow that is to say, the stalk is removed by hand from the tow, and not the tow from the stalk. The stems are from 4 to 5 metres long and their circumference at the base varies from 3 to 5 cm.; further the amount cultivated by each grower is small (for the land is much subdivided), so the tow is not so laborious as would at first sight appear; for which reason, no attempt has been made to substitute more rapid mechanical work for this manual labour. The tow after being made into hanks, is sold on the markets of Carmagnola, Vigone, Carignano and Pignerola. The hemp is known by a number of new technical names. The type called "buona" at Bologna, "macerata in tiglio" at Rovigo, and "extra," in Naples is sold in Piedmont under the title of "naturale". The fibre of stalks that have been cut by hail or are insufficiently developed is called "moletto", while the product of female plants that have borne fruit, and the tow of stalks retted by the dew, pass respectively under the names of "meschiasso" and "antersecco."

During the season an average of nearly 70 tons of first quality tow is sold weekly at the above-mentioned markets. It is always sold uncombed, for the combed hemp is all taken up by a hundred domestic-rural rope factories at Carmagnola.

100 kg. of raw tow yield: 37.75 extra tow; 35 kg. ordinary tow + 16.25 kg. of residuum (roots, oakum); 11 kg. of heterogeneous substance (dust).

The 16.25 kg. of residuum furnish an excellent textile fibre that can be used in rope-making. The only really waste product is the dust; this comes from the soil adhering to the roots (in Piedmont the hemp is not cut, but pulled up), or found in the retting water. The sole defects of Piedmontese hemp are its want of flexibility and the coarseness of the fibre which limit its use in rope-making.

In order to obtain a fine flexible fibre, it is only necessary however to sow the hemp more thickly instead of planting 40 to 50 seeds per square metre, or at the rate of 30 to 50 litres per hectare (300 litres per hectare in France) according to the present custom. On the other hand, broad sowing has the advantage of producing much larger seeds which are greatly appreciated and are even more profitable than the tow. In 1920, they weighed 708 lire per quintal. The result of sowing this hemp in the Loire valley was to increase the production by about 30 %. The characters it have made it celebrated are: resistance to bad weather, immunity to certain plant parasites and luxuriant growth.

The industrial treatment of the fibre is still based on antiquated methods and a large wooden wheel turned by hand is employed. The "Cassa Rurale" Villanova Solaro is setting up modern plants.

The conditions at Carmagnola are most suitable for a hemp-factory, for the supply of electric power is plentiful and there are abundant means of communication with the sea through Genoa, and the interior and foreign countries, via Modane and the Simplon.

8 - The *Agave* and *Fourcroya gigantea* at Tran-Ninh Indo-China. — MEVILLÉ M. R. (Chef de la Station agricole du Tran-Ninh), in *Bulletin agricole de l'Institut Scientifique, de Saigon*, Year 3, No. 11, pp. 360-364. Saigon, November, 1921.

AGAVE. — Description of the distribution, development of the plant and extraction of fibre with reference to plants under observation at Tran-Ninh.

The leaves of 1.50 m. length weigh on an average 2.35 kg., and 90 gm. dry fibre are obtained, i. e. a yield of 3.83%. If the fibre proves to be of superior quality there appears to be no reason why the method of extracting fibre should not be facilitated and the industry extended. The country round Tran-Ninh is peculiarly adapted to the cultivation of the agave.

Fourcroya gigantea. — Bulbs were imported into Indo-China from France in 1911 and proved very adaptable to the new climatic conditions. The first collection of leaves was made in 1919, and it was found that 100 kg. of leaves gave 2.186 kg. of washed and well dried fibre. The fibre was larger than that obtained from agave, and was very white and strong. Air drying or sun drying has been found equally effective and the process is rapid, only requiring a few hours. The "Monodéfibreuse" machine is recommended owing to easy transport, etc. A new plantation was made in 1921 on a steep slope and is so far progressing satisfactorily. *F. gigantea* can be planted with success under trees with their leaves. Fine specimens have also been noticed growing in thickets. Tran-Ninh. Drought appears to have no ill effect.

Details are given of propagation, planting, arrangement of plantation (spacing, etc.), cultural operations, defibration, etc.

169 - Giant Grasses for Paper-Making (1) in India, Africa, Australia and the West Indies. — In *Bulletin of the Imperial Institute*, Vol. XIX, No. 2, pp. 174-189 and Vol. XIX, No. 3, pp. 271-282. London, 1921.

A summary of work already done in connection with the utilisation of several species of wild large stemmed grasses, exclusive of bamboos. Apart from the giant forms, reference is also made to certain smaller grasses when these occur in association with the giant kinds or might be employed in paper-making in conjunction with them.

INDIA. — *Ischaemum angustifolium* Hackel (= *Andropogon involutus*, Stendel) the "sabai", "baib" or "bhabar" grass of Northern and Central India. This grows to a height of 6-7 ft., and gives two abundant crops a year without irrigation. It yields 40 % or more of cellulose. According to RAITT it is one of the best and cleanest materials known for the production of the finest printing and medium quality writing paper; even the nodes do not offer any serious resistance to the action of reagents.

Themeda gigantea, Hackel, sub spp. *arundinacea* and *villosa*, "ulla-grasses". The larger form is most abundant in N. W. India, growing to a height of 17 ft., and estimated to yield 3.5 tons per acre per annum if cut on a 3-years rotation. RAITT gave its composition as over 50 % cellulose, 28 % pectose etc., nearly 15 % water solubles and over 6 % lignin; average length of ultimate fibres as 2.87 to 2.9 mm., classing it first among Indian savannah grasses. When tested on a commercial scale both in India and in England, it was found difficult to bleach and hardly answered expectation but it could no doubt be used advantageously for admixture.

Phragmites Karka, Trinius (= *P. Roxburghii*, Kunth) "nai". This grows from 9-14 ft. high, its yield being estimated by HOLZ at 3.2 tons per acre per annum on a 2-years rotation. Composition is nearly 48 % cellulose, 33 % pectose, etc. 12 % water soluble and 7 % lignin, its ultimate fibres averaging 2 mm. in length; yield 39 % unbleached pulp. It is considered a first class paper-making grass.

Saccharum spp. — *S. arundinaceum*, Retz, apparently including *S. procerum* and *S. exaltatum* Roxburgh, is a widely distributed gregarious species, occurring throughout India up to altitudes of 4,000 ft. It takes 3-4 years to reach maturity, and should therefore be cut on a 4 to 5 years rotation. It grows 18 to 23 ft. in height and gives a yield of 14.8 tons of dry material per acre per annum; the yield is stated to be best at the flowering season. The percentage of bleached fibre from the entire plant is stated to be 36.5, the composition of the plant being 52.9 % cellulose, 9.1 % lignin, 27.5 % pectose etc. and 10.5 % water soluble matter. This is classed among the best of the Indian savannah grasses whether for use

(1) For Plants used for Paper-Making and the Utilisation of Bamboos, See R. NAG, 1921, No. 498. (Ed.)

by itself or for admixture and its yield per acre is more than twice the amount of any other species.

S. ciliare Anderss. (including *S. Munja* and *S. Sara*, Roxburgh). This grows to a height of 17 ft. and under a three years rotation will give 5.6 tons of material per acre per annum and yields 40 % bleached fibre. Composition of entire plant 51.4 % cellulose, 32.6 % pectose etc., 10.7 % water soluble matter, 5.3 % lignin. The nodes are very slightly lignified and the pulp bleaches well, resembling that obtained from wheat straw.

S. Narenga Wallich. Occurs in the sal forests from the Sub-Himalayas to Burma, grows 18 ft. high and gives 3.5 tons per acre per annum on a 3-years rotation. It contains 48 % cellulose, 33.9 % pectose, etc., 11.3 % water soluble matter, 6.8 % lignin. It is considered of equal value to *S. ciliare*, *S. arundinaceum*, and *S. spontaneum*.

S. spontaneum. — Widely distributed and gregarious species, occupying thousands of acres in Assam and reaching altitudes of 6000 ft. in the Himalayas. It has vigorous underground growth and sends up culms 7-14 ft. high. Yield 7.8 tons of air-dry material per acre, or 2.9 tons per annum on a 2-years rotation; ultimate fibre 0.8 to 2.8 mm. in length; content 45.8 % cellulose, 36.2 % pectose, etc., 9.4 % water soluble material, 8.6 % lignin. The stems are apparently very satisfactory as pulp material, but the leafy heads do not bleach well. The species occupies flooded or moist areas and occurs also in S. China and in the Caroline Islands.

S. fuscum Roxburgh (= *Miscanthus fuscus*, Benthani) 5-9 ft. high requiring a 2-years rotation; a native of moist ground in Assam, Bengal and Burma; estimated to give 2.3 tons per acre per annum, but classed by RATTR as somewhat inferior in strength.

Erianthus Ravennae Beauvais (= *Saccharum Ravennae* L.) "Pampas grass". Grows 17 ft. in height and is estimated to yield over 7 tons per acre but should be cut on a 3-years rotation; fitted only for use in admixture.

Imperata arundinacea Cyrill (1) (including *I. cylindrica* and *I. Koenigii* "lalang." Reaches altitudes of 7000 ft.; has a creeping rhizome with erect solid culms 1-3 ft. high. Var. *latifolia* 3-4 ft. high with broader leaves found in the warmer parts of the Himalayas. Under a 2-years rotation could yield 1.7 tons dry grass per acre per annum. It is used at the present time in conjunction with bamboo etc. in paper mills in Indo-China and Queensland (2) and has proved successful in the Federated Malay States.

I. exaltata Brongniart, grows gregariously and is resistant to drought, ultimate fibres 0.46-1.82 mm. in length; for cheaper printing papers, but poor in colour.

Arundo Donax L. "Spanish reed." Widely distributed in warm and wet districts grows from 5-16 ft. in height; estimated to yield over 3

(1) See R. Feb. 1917, No. 149, and R. May 1921 No. 498. (Ed.)

(2) See R. Nov. 1916, No. 1162, and R. May 1921, No. 498. (Ed.)

tons per acre per annum on a 2-years rotation. Composition nearly 43 % cellulose, 33 $\frac{1}{2}$ % pectose, etc., 14 % water soluble matter and over 9 % lignin. Ultimate fibres average 1.5 mm. length. Paper produced is of fairly good quality and the plant is placed in the first class of Indian savannah grasses by RAITT and HOLE.

Andropogon intermedius R. Brown. (Referred to by STAFF as *Amphiplophus*). Widely distributed up to 8 000 ft. in India, N. Australia, Tropical Africa and W. Indies. Grows 7 ft. high; yields about 4 tons per acre or 2 tons on a 2-years rotation; classed as 2nd class paper making material.

Heteropogon contortus ("spear grass") Roem and Schults (= *Andropogon contortus* L.) widely distributed throughout the plains up to 5 000 ft.; grows 3-4 ft. high and estimated to yield 1 ton per acre on a 2-years rotation. When tested by RAITT it proved too refractory to serve as a pulp-material even in admixture form.

Pennisetum Alopecuroides ("Moya grass") Stendel. From 15 000 to 20 000 tons available annually in neighbourhood of Pench Valley, coal-field in Central Provinces; said to yield 39 % of easily bleachable pulp.

Eragrostis cynosuroides, Roem and Schults, "dab" grows on barren sand in N. India. Perennial growing, 5ft. in height; estimated by HOLE to yield 1 ton per acre per annum on 2-years rotation; ultimate fibres average only 0.94 mm. in length and the pulp proved weak and difficult to bleach. It is considered therefore suitable only for admixture with superior grass pulp in a proportion not exceeding 10 %.

SOUTH AFRICA. — Tambookie Grasses (1). — Reference is made to *Cymbopogon validus* Stapf (= *C. Nardus* Rendle var. *validus* = *C. marginalis* var. *validus* Stapf). *C. excavatus* Stapf (= *Andropogon Schananius* L. var. *versicolor* Hackel), *C. hirtus* Stapf (= *Hyparrhenia hirta*), *C. auctus* Stapf, *C. Ruprechtii* Rendle (= *Hyparrhenia Ruprechtii* Fourm), *Andropogon ceresiaciformis* Nees (= *Monocymbium ceresiiforme* Stapf), *A. Dregianus* (= *Hyparrhenia Dregiana* Stapf.) and *Erianthus Sorghum* Nees.

Andropogon Buchanii Stapf. "dek" or thatching grass has also been tested at the Imperial Institute (1).

Trachypogon plumosus "stek grass" Nees. — Comprises most of the forms included under *T. polymorphus* Hackel and under this name a sample was reported on by the Imperial Institute (2).

Themeda triandra Forsk (including African forms of *T. Forskalii* Hackel (1), *Anthistiria imberbis* Retz and *A. ciliata* Nees). Examination proved that the ultimate fibres are mostly 1.5 to 2.0 mm. long, and yield about the same quantity and quality of pulp as the "tambookie" and "dek" grasses; the nodes are, however, harder and would necessitate thorough boiling and beating.

(1) See R. Feb. 1920, No. 202. (Ed.)

(2) See R. May 1921, No. 498. (Ed.)

Sorghum halepense "Johnson grass".

Andropogon hirtiflorus Hootefel. var. *semiberbis* Stapf. (= *Schizachyrium semiberbe* Nees (1)).

Tristachya Rehmanni Hackel (1).

Aristida sp. gave pulp inferior to ordinary chemical wood pulp, but would be only profitably manufactured for local use (*Union S. Africa Industries Bull.* No. 7, 1919, p. 66).

Panicum obscurans Stapf, also known as *Isachne obscurans* Woodrow (1).

WEST AFRICA. — Ten different species have quite recently been received from Nigeria for a test of their suitability for paper manufacture.

1) *Imperata cylindrica* Beauv. "ekong". Chemical examination gave moisture 10.1 %; cellulose 41.3 %, ash 5.2 %. The ultimate fibres measured from 0.6 to 1.3 mm. Tests proved that the refractory part of the material consists of the hard rhizomes and that, if care is taken to exclude these in collecting the grass, a fair yield of pulp of good quality will be obtainable.

2) *Pennisetum* sp. "esun". Composition: — moisture 10.1 %, cellulose 41.6 %, ash 7.3 %.

Under drastic conditions with caustic soda, the grass furnished a pulp which broke up fairly well, bleached to a fairly satisfactory cream colour and felted well, giving a good strength of paper. The yield was however rather low.

3) *Andropogon tectorum* Schum. Composition: — moisture 10.8 %, cellulose 44.2 %, ash 4.2 %. The pulp bleached well to a pale cream colour and yielded a paper of fairly good strength.

4 and 5) *Andropogon Gayanus* Kunth. Two specimens "jinfi" and "gamba" both identified at Kew as *A. Gayanus*: "Jinfi" contained moisture 8.9 %, cellulose 50.9 %, ash 4.0 % and "gamba" moisture 8.8 %, cellulose 49.3 %, ash 3.8 %. Both gave a well disintegrated pulp giving strong good quality paper; less caustic soda was required for "jinfi".

6) *Chasmopodium Afzelii* Stapf, vel sp. nov. "sasari". Composition, moisture 8.8 %, cellulose 44.6 %, ash 6.1 %; somewhat drastic treatment with caustic soda was found necessary and resulted in a pulp with excellent felting powers giving a good white paper.

7) *Cymbopogon giganteus* Chiov. "tsauri". Composition moisture 9.1 %, cellulose 50.0 %, ash, 5.0 %. Very drastic treatment necessary; when the temperature was increased to 160° C, a satisfactory result was obtained and a paper of good strength.

8) *Hyparrhenia rufa* Stapf. "Yama". Composition: moisture 9.3 %, cellulose 40.9 %, ash 7.6 %; drastic treatment required resulting in a well disintegrated pulp of good quality and strength.

(1) See R. Feb. 1920, No. 202; R. May 1921, No. 298. (Ed.)

H. rufa Stapf. "Kitsi gujma", moisture 8.9 %; cellulose 42.0 %, ash 6.3 %; results similar to first species but requiring less drastic treatment the sample being rather thinner and less mature.

9) Mixture of *Andropogon Gayanus* Kunth, *Hypparrhenia subplumosa* Stapf. and *Trichopterix* sp. "baya Maria". Composition: moisture 9.2 %, cellulose 40 %; ash 5.0 %. The pulp did not break up sufficiently at first beating, but after bleaching and further treatment gave a strong opaque paper of satisfactory quality and colour.

10) *Ctenium elegans* Kunth, "wuchiyan bera". Composition: moisture 8.3 %, cellulose 47.6 %, ash 3.1 %. Requiring at least a 20 % caustic soda treatment to give a pulp which after bleaching broke up well and gave a strong white paper.

EAST AND CENTRAL AFRICA. — *Pennisetum purpureum*, Schumacher (= *P. Benthianii* Stendel). "Elephant Grass" culms reach 6.10, or 20 ft. in height — in smaller form grows at an altitude of 5 000-6 000 ft. — very abundant. It has been calculated that 2 crops could be cut annually, yielding 60 tons dried grass per acre, from which 25 tons of pulp could be obtained. The favourable results obtained on a laboratory scale have been confirmed by a large-scale trial conducted at a paper mill in the United Kingdom, and the material has since been used for Government printing paper in Uganda and appears quite satisfactory.

AUSTRALIA. — *Imperata arundinacea* (See India). It may be added that it has been employed for pulping on a small scale at Cairns, Queensland (Bulletin No. 11, 1919, Commonwealth Advisory Council of Science and Industry). Its utilisation for paper-making is not considered as likely to be profitable.

Triodia irritans R. Brown. Tested but found unsuitable (See Bull. mentioned above).

Spartina cynosuroides Roth (= *S. Schreberi* J. F. Gmelin), recommended for cultivation as a paper material in Victoria. It is a native of freshwater swamps in eastern N. America.

WEST INDIES. — *Panicum molle* Schwartz (= *P. barbinode* Trinius). "Para grass". This has been employed to advantage in Trinidad in conjunction with bagasse and bamboo. It has been previously estimated by CARMODY that 30 000 tons of bagasse-pulp, worth £12 per ton, available annually in Trinidad, would be increased in value to £15 per ton by the admixture of bamboo and para grass.

P. myuros "canelote". Strong, but pulp only suitable for wrapping paper.

Uniola racemiflora Trinius (= *U. virgata* Grisebach). Stated to be useful for paper pulp although inferior to esparto.

CONCLUSIONS. — Except in the case of the Indian Savannah grasses it has yet to be definitely ascertained how far those giant grasses taken as a whole, could withstand repeated cropping, or on what rotation this would be possible. Careful local surveys would also be necessary to determine the existence of adequate and accessible supplies to meet the demands of the mills, etc. In every case where export is concerned, it is

necessary that the grass should be converted into "half-stuff" in the country of origin, as under present conditions, the raw material would not realise a sufficiently high price in Europe to justify the cost of transport.

- 170 - **The Oil-Bearing Sunflower on the "Riviera di Ponente", Italy.** — PERSICO, W. in *Costa Azzurra Floreale-Agricola*; reprinted in *Rivista dell'Associazione italiana pro Fianze medicinali, aromatiche ed altre utili*, Year IV, No. 10, pp. 155-156. Milan, October 1921.

PLANTS
YIELDING OILS,
DYES, TANNINS
ETC.

The author recommends that the large, one-flowered, so-called Russian variety of *Helianthus annuus* should be grown as an oleiferous plant in the Riviera di Ponente, as its product is quite equal to olive-oil. Very satisfactory trials have been made in the experiment vineyards and rose-gardens of Pietralunga, where it has been found that about 20 quintals of seed per hectare may be expected. The seeds give 15 % of oil and 80 % of sunflower-seed cake, or 3 quintals of oil and 16 quintals of cake per hectare. Without irrigation, some plants, 46 cm. in height and with heads 46 cm. in diameter, were obtained.

The seeds of the sunflower are not only used for cakes, and in a variety of other well-known ways, but also supply an excellent flour for cake-making, while the stalks furnish a silk-like fibre and an ash with a high potash content. A brilliant yellow dye is obtained from the petals, and the leaves are used instead of those of *Datura Stramonium* as a remedy for asthma (1).

- 171 - **Gemsbok Beans (*Bauhinia esculenta*) as a Source of Oil.** — See No. 162 of this Review.

- 172 - **Mangrove Species valuable as a Source of Tannin, in the Sunderbans, Forest Division of Bengal (India).** — DAS, B. M. (Superintendent, Calcutta Research Tannery), in *Journal of Indian Industries and Labour*, Vol. I, Pt. 4, pp. 482-490, Tables II, bibliography of 16 works. Calcutta, Nov. 1921.

Although the species found in the various mangrove swamps of the world resemble one another the tannin content varies greatly in different regions, e. g. the bark of *Rhizophora mucronata* is reported to have on the average 20.5 % tannin in Borneo and 30 to 40 % in the Malay States. Hence the investigation of the mangroves in one region is no criterion of their economic value elsewhere. The Government of Bengal therefore deputed J. A. PILGRIM to make a systematic investigation of the tanstuffs of a promising area, namely the Sunderbans Forest

(1) For the use of the sunflower as a forage plant, see: R. April 1919, No. 493; R. Oct. 1920, No. 1008; R. March 1921, No. 289; R. Aug. 1921, No. 819; R. October, 1921, No. 1003.

Chopped sunflower stalks steamed for 3-4 hours make a good pig-food which the animals eat readily. As forage these stalks are superior to the straw of cereals: this is shown by the following analysis made at the Versuchsstation der Brandenburgischen Landwirtschaftskammer: Water 7.8 % — Crude protein 0.8 % — Crude fat 0.7 % — Nitrogen-free extracts 31.8 % — Crude fibre 33.8 % — Ash 13.1 % — M. KRAUSE in *Deutsche Landwirtschaftliche Presse*, Vol. XLIV, p. 684. Berlin, 1917. (Ed.)

Division on the South coast of Bengal. The main divisions of the work may be outlined thus :— a) general survey of the various species; b) estimate of the species that predominate; c) collection of the various parts of the trees with the object of ascertaining their tannin contents; d) analysis; e) deductions regarding suitability for the manufacture of tannin extracts or for direct use in tanneries; f) small scale tanning tests with promising materials.

Reports were made on 18 varieties of which the following are the commonest in the Sunderbans :— 'sundri' (*Heritiera minor*), 'goran' (*Ceriops Roxburghiana*), 'gengra' (*Excoecaria agallocha*), 'keroa' (*Sonneratia apetala*). Good extracts can be made from several species, but the two first-mentioned, are the most common and abundant and their exploitation for this purpose may be regarded as of immediate commercial interest.

'Pussur' (*Carapa moluccensis*), a less abundant variety gave a valuable material; extract made from the wood is expected to produce a tannage similar to that of quebracho extract which is largely used by tanners in Europe and America. Large scale tanning experiments with the above-mentioned promising materials are recommended.

The importance of careful collection and preservation of tannin for their ultimate tannin content and colour has been proved. PILGRIM found the best method for preserving them in good condition was crushing and drying in the sun soon after collection from the leaves. The immediate crushing and drying kept the materials free from fermentation by expelling the moisture, and consequently preserving the tannin undeteriorated. In crushing, iron was as far as possible avoided and drying was done in the sun and in two cases only was artificial drying found necessary. In this way the formation of the unattractive reds through fermentation and oxidation in many tanning materials will be much reduced resulting ultimately in a better coloured tannage.

A striking illustration of badly preserved samples is given by the figures of analysis of some British East African mangroves. Well preserved samples of *Rhizophora mucronata* (1) gave 47.99 % of tannin and, badly preserved, 21.30 % only. Similarly, BLOCKEY reports some analyses of Indian mangrove barks and an interesting comparative percentage table is given for the BLOCKEY and PILGRIM analyses respectively: *Bruguiera gymnorrhiza* (1) 9.7 and 31.55, *Kandella Rheedii*, 17.3 and 13.34, *R. mucronata*, 4.5-6.1 and 35.0.

In the present investigation, not only were bark, fruit, leaf and wood collected, but samples were also taken of the bark of twigs, branches and bole, of the outer husk and the inner kernel of the fruit, and of the young and mature leaves, of the branch and the bole wood.

Two main factors have been brought to bear upon the discussions regarding the suitability of the various materials analysed for extract man-

(1) See K. Sept. 1920, No. 871. (Ed.)

mufacture, namely: 1) the proportion of tannin to soluble non-tannin present in the material and; 2) the chloride content. Care was taken to calculate the yield of the extract in popular commercial forms, the expected percentages of tannin in the extracts and the quantity of material required to run an extract plant of suitable commercial size, *i. e.* with a daily capacity of 3 tons. Both in yield of extract and in percentage of tannin the following species stand out conspicuously: bole barks of *Rhizophora mucronata*, *Ceriops Roxburghiana* and *Bruguiera gymnorrhiza*.

The use of crude tanning materials is being fast supplanted by tannin extracts owing to the fact that the tanner can thus obtain tannin in concentrated form and the use of strong solutions is rendered possible which quickens the tanning process. This has given rise to a method by which leathers can be tanned in a week, whereas the process formerly took 6 months. The easy transport and consequent saving of freight are also of importance.

Besides their use for tanning, mangrove extracts are largely employed for waterproofing fishing nets and sails, and also to a large extent as a substitute for cutch (*Acacia Catechu*) in dyeing. PILGRIM discovered 2 materials very suitable for this purpose viz.; the waxy outer cortex barks of *Carapa moluccensis* and of *Bruguiera gymnorrhiza*. As the removal of this dead outer cortex scale is not likely to damage the trees, the supply of materials, especially of the former, is likely to be abundant.

As regards mixed mangrove extracts it is considered possible to make a useful tannin extract from suitable mixtures of 'babul' (*Acacia arabica*), myrabolan (*Terminalia belerica*) and 'goran' (*Ceriops candolleana*), the 3 standard tanstuffs of Bengal; by varying the proportions of the components, it would be possible to meet the requirements of different kinds of leather.

173 - Utilisation of Serum in the Dilution of *Hevea* Latex. — DE VRIES, O., in *Bulletin Agricole de l'Institut Scientifique de Saigon*, Year 3, No. 10, pp. 332-334, Tables 3, Saigon, Oct. 1921. Reproduced from *Mededeelingen van het Centraal Rubberstation*, No. 28, Buitenzorg, 1921.

RUBBER, GUM
AND
RESIN PLANTS

In the preparation of rubber, the serum residue after coagulation has been occasionally employed for the dilution of the latex, either from the point of view of economy as regards acetic acid or owing to the lack of fresh water. It appears from the results hitherto obtained, that serum thus used has no appreciable effect on the properties of the forthcoming rubber. This would seem evident from the data appended, comparing the resistance to abrasion, standard time for vulcanisation, slope and viscosity.

It is this method of preparation is followed for several consecutive weeks, the natural accelerating action arising from the decomposition of the serum albuminoids will result in a speedier preparation of rubber. When, however, sodium bisulphite is added to the latex at regular intervals, the time taken for vulcanisation is not affected to any noticeable extent, if at all. The use of old serum tends however to encourage more rapid vulcanisation.

Apparently also with latex thus diluted, the composition of the liquid in which the rubber globules are suspended remains the same or perhaps only slightly changed, owing to the fact that to obtain the serum, the latex was coagulated with acetic acid. The following data indicate the relative effects of dilution with water and serum on the time taken for vulcanisation.

Latex diluted at 15 % with water, standard time for vulcanisation	120 min. at 7.5 %	125 min.
" " " " " serum	105 " "	110 min.
Non-diluted	105 " "	

These results were obtained with a coagulum which was converted into crêpe 5 hrs. after coagulation.

By diluting the latex at 7.5 % rubber content with water and serum in proportions so that the serum dilution is equal to a water dilution of the latex at 15 %, the time for vulcanisation amounted to 120 min., i. e. the same as with latex diluted with water at 15 %. After conversion into crêpe the day following the figures were:—

Latex diluted at 15 % with water, standard time of vulcanisation	= 110 min. at 7.5 %	120 min.
" " " " " with serum	= 85 " "	
Non diluted	= 95 " "	

The fact still remains unexplained that when serum is employed, the vulcanisation appears to advance more quickly. However, the results of experiments already made indicate that the time necessary for vulcanisation of rubber depends more especially on the concentration (composition) of the liquid when the coagulation takes place, i. e. the quantity of serum with which it is associated.

174 - Observations on the Camphor Plant (*Blumea balsamifera* D. C.) in Indo-China. — VERNET, N. G. in *Bulletin agricole de l'Institut scientifique de Saigon*, Year 3, No. 11 pp. 345-353. Saigon, Nov. 1921.

As a result of a communication received from GARNIER (Directeur de l'Agence Economique de l'Indochine) dated Feb. 11, 1920 with reference to the possible utilisation of the Indo-Chinese camphor plant (*Blumea balsamifera*) for the extraction of borneol, specimens from various quarters have been distilled to test their possible value, according to directions given by GARNIER in conjunction with Prof. PERROT (Directeur de l'Office National des Matières premières pour la droguerie, pharmacie, distillerie et parfumerie). The Bussy apparatus used in the "Institut Scientifique de l'Indochine" for distillation has already been described (1).

The results obtained combined with records concerning the preservation of samples have made it possible to compare the borneol yields derived from leaves: 1) submitted to varying periods of preservation; 2) distilled fresh or dried; 3) of varying age; 4) from districts where after collection of the leaves there has been some defect in the preparation. Unfortunately up to the present it has not been possible to study seas-

(1) See R. Oct. 1920, No. 1030. (Fd.)

onal influence. Apart from the data given as regards badly preserved or insufficiently dried samples, etc., the author gives a table showing all the superior yields obtained from dried leaves with a note that their condition of dryness appeared satisfactory, the leaves not having fermented and showing no sign of mould. Taking the samples from Quang-Khe as an example, the data are as follows: weight of leaves distilled, 41 kg.; crude camphor obtained 0.51 kg.; yield per 1000 12.44 kg.; essences, trace. Comparing these figures with those for samples from various other districts the yield of crude camphor, varies from 7 to 12 per 1000.

The relation between the yield of camphor and of essence is worth noting. The fact that certain samples with a high camphor content showed only traces of essential oil may be attributed either to the transformation of the latter into camphor by oxidation in air or to speedy evaporation of the essence during dessication. This is still an open question, but as regards industrial value there does not appear to be any advantage in undertaking the laborious operation of dessication of the leaves before proceeding to distillation, and it is advisable to proceed directly with the treatment of the green leaf immediately after plucking.

The question has arisen as to the economic value of the distillation process. MAGEN "Chef du Service Agricole de Cochinchine", forwarded to Giaray a request for an estimate of the costs of collection of leaves from an area covered with a very thickly growing mass of *B. balsamifera* and the information supplied to him by ANGLÈS, "Chef de la Station de Giaray", is as follows: 500 plants of *Blumea*, age from 1 to 2 years give 225 kg. of leaves, and the cost of collection amounts to \$6.00 (estimated yield per plant is 0.45 kg.). Estimated cost of collection of 1000 kg. is \$24.00.

Until a more advantageous arrangement is made both as regards collection cost and a regular sale it seems doubtful whether the utilisation of *B. balsamifera* can be considered industrially profitable in Indo-China.

175 - Characters and Use of Cuica Resin derived from *Cercidium spinosum*. - *Bulletin of the Imperial Institute*, Vol. XIX, No. 2, pp. 144-145. London 1921.

In a previous account of the examination of "cuica" or "quika" resin (1) which is derived from *Cercidium spinosum* Tulasne, a small tree, native to Columbia, it was stated that the material was inferior to other resins for the preparation of spirit, turpentine or oil varnishes, but in order that conclusive trials might be made, a further supply was obtained from Columbia last year. The new sample examined was similar to the earlier sample, but contained a rather larger proportion of bark. The percentage composition of the present sample on analysis at the Imperial Institute, London, was found to be as follows: moisture 2.1, matter insoluble in boiling alcohol, 15.3 (consisting chiefly of bark), matter soluble in boiling alcohol (resin), 82.6, ash 2.1.

(1) See R. May 1921, No. 501. (Ed.)

After practical experiments at a varnish manufacturers, "cuica" was found to be not very satisfactory as a resin in the preparation of oil varnishes and it is considered that the only possible use to which it could be put would be in the preparation of tin lacquers in which benzol or similar solvents could be used. It appears doubtful whether it could be sold remuneratively in competition with better materials already available and it would have to be offered at a price between those for Manila resin and common resin (about £1 to £2 per cwt, May 1921), the value depending on the purity of the material.

176 - Notes on the Cultivation and Commercial Value of *Carica Papaya* in Ceylon and Future Possibilities in India: Investigations on the Composition of the Fruit. —

I. SANYAL, PHANI BHUSAN, The Plant *Carica Papaya* and its Enzyme, in *The Agricultural Journal of India*, Vol. XVI, Pt. V, pp. 496-507. Calcutta, [Nov. 1921]. — II. CHALOT, C., and BONNY, R., Composition de la Papaye, in *L'Agriculture Coloniale*, Year 6, No. 46, pp. 130-135. Paris, Oct. 1921.

I. Information is given regarding the trade of Ceylon in the economy product, papaya, which up till now has been the chief source of supply to other countries, but it appears that at present the demand for unadulterated papain is in excess of the supply. From a rough estimate given as follows of the selling price and also the cost of production of papain, it appears that the papain industry in India would also be quite lucrative.

	Per acre	
	Minimum 400 trees (Bombay Pres.) lb.	Maximum 500 trees lb.
Papain at $\frac{1}{2}$ lb. per tree (in Ceylon the yield being $\frac{1}{2}$ to $\frac{3}{4}$ lb. per tree)	200	250
	Rs.	Rs.
Selling price at Rs. 5 to 6 per lb.	1000	1500
Deducting the cost of cultivation, collection and preparation etc.	200	250
Profit from papain	800	1250
Profit from fruit left after extraction	200	250
Net profit	1000	1500

The activity index (i. e. the quantity of protein digested per unit weight of papain in a fixed time and at a particular temperature) has been found to vary much in the trade samples. As estimated by the PRATT method on milk protein (*Philippine Journal of Science* (1915) 10, pp. 1-33), commercial specimens from Ceylon gave the following numbers: 0.1, 5.6, 9.7.

Cultivation. — Although usually propagated by seeds, recently asexual propagation (grafting) has been tried with some success in Amer-

ica (1) (*U. S. Dept. of Agr. Bureau of Plant Industry, Circular 119*) and also in Lucknow (India) (*Dept. of Land Records and Agriculture U. P. of Agra and Oudh. Bull.*). It has been claimed that trees so propagated fruit more quickly than seedlings. The latter are ready for transplanting about 1 month after germination and can be planted in their permanent positions at 10 ft. intervals a month later.

The following fertiliser has been successfully tried at the Hawaii Experiment Station (2) for young plants (in lb.):— superphosphate 800 + sulphate of potash 315 + nitrate of soda 250 + sulphate of ammonia 190 + black sand (volcanic ash), 445. This has been applied at the rate of 1 lb. per tree at planting time. In the Bombay Presidency, house or farmyard manure at the rate of 20 cartloads per acre has been used with success. It has also been found that 2 ploughings and 2 harrowings just before sowing improved the growth of the plants.

It is interesting to note with reference to the production of both male and female flowers that on many occasions male flowering plants have been found to change their sex *e. g.* a tree 1 ½ years old had produced only staminate flowers (1); the top of the tree was cut off and leaves plucked. After some months new branches appeared and these bore fruit.

I. II. COMPOSITION AND COMMERCIAL VALUE. — The general composition of the papaya fruit is shown by the following percentage analysis, water 90.75, protein 0.80, fat 0.10, nitrogen free extract 6.32, fibre 1.09, ash 0.94. The most important property from a biochemical point of view is the proteolytic power possessed by the latex of the fruit (2). In order to make a comparison between the analyses of several different seedling strains, the authors (II) have included a reproduction of records kept at the Hawaii Experiment Station, relative to strains coming from Trinidad, South Africa, Honolulu, Barbados, Tahiti and Panama. Apparently the sugar content consists principally of invert sugar, only traces of sucrose being present.

These records also include data with regard to the composition at various stages of maturity. The insoluble solids are about 3 % in the green and decrease to about 1 % in the ripe fruits. The ash, acid and protein occur in small quantities and are quite constant. The sugars in the green fruit do not exceed 2 % but increase rapidly as the fruit increases in size and ripens.

(1) In the *Manual of Tropical and Sub-Tropical Fruits* (Wilson POPEHOE), Chap. V¹, p. 231 (Papaya and its Relatives), it is stated that "later experience has shown that when propagated by this means in Florida, a given variety degenerates rapidly, and in the third and fourth generation from the parent seedling, the grafted plants make very little growth and their fruits are small and practically worthless. The explanation of this behaviour has not been found, nor is it known whether it will occur in other regions but its effect in Florida has been to do away with grafting and cause all growers to return to seed propagation. (Ed.)

(2) For Papaya in Hawaii See R. July 1914, No. 643. (Ed.)

PREPARATION OF CRUDE PAPAIN. — A sample of papain prepared at Pusa (I) was found to contain the following percentages; total nitrogen 9.10, albuminoid nitrogen 2.44, ammoniacal nitrogen 0.59, ash 6.92, lime 1.21, magnesia 2.19, potash 0.69, soda 0.60, phosphoric acid 0.96.

A medium sized fruit will furnish at least 100 gm. of latex. The author (I) describes the various methods of purification of crude papain and adds details of the determination of proteolytic activity of the papain purified in these various ways at Pusa, the figures showing that the samples thus prepared, compare favourably with the best marketed products from the Philippines, Mexico or Ceylon. He draws attention to certain points worthy of attention in the preparation process and in order to ascertain the effect of temperature and reaction of the medium on the rate of action of papain, tests were made with results indicating that the sample acted best in neutral and very slightly acid solution. A small quantity of alkali was found to decrease the activity considerably, but it did not totally stop it, as would be the case with pepsin. The fact that the quantity of coagulable protein digested was so great at temperatures as high as 80, 90 and 95° C no doubt explains why a few pieces of unripe papaya will very quickly soften almost boiling water.

177 — **Banana-Growing in Porto Rico.** — GONZÁLES RÍOS P., in *Gobierno de Puerto Rico, Departamento de Agricultura y Trabajo. Estación Experimental Insular, Río Piedras. P. R. Boletín* No. 25, 30 pp., figs. 10. San Juan, 1920.

The chief banana growing countries are Central America and the Antilles; the largest quantities being produced at Costa-Rica and in Jamaica. The banana is the favourite fruit at Costa-Rica, the green varieties forming the principal food of the poorer classes. The whole crop is consumed in the country, and until quite lately it not infrequently happened that St. Domingo bananas were offered for sale in some of the markets of the island.

At Porto-Rico, the banana has never been systematically and scientifically cultivated and the tree may be said to grow wild.

Most of the districts where coffee is cultivated, such as Yanco, Lares, Adjuntas, Utuado, San Sebastián, Maricao, etc., are great banana-growing centres, for the tree affords an excellent shade to the coffee plantations, and the workers receive most of their wages in the form of the fruits.

Banana-growing in Porto-Rico has a great future before it.

The main object of the Bulletin analysed is to classify the different varieties of banana trees found in the island, and to describe some of the cultural experiments which have been made. It also gives an account of the cultural methods now employed and those which should be adopted.

The following varieties growing in Porto Rico are described by the

(1) See *R. Feb.* 1916, No. 182. (Ed.)

(2) See *R. July* 1915, No. 820. (Ed.)

author: "Guineos dátiles" (*Musa sapientium*) — guineos enanos (*M. Cavendishii*) — chamaluco (*M. normalis*), the fruits of which are used for cooking while still green — "guineo gigante", or "guaranes" (*M. sapientium*) with large bunches; this is the variety specially grown in Jamaica, and supplies most of the bananas exported to the United States, plátano común, plátano enano, plátano congo, plátano harton, plátano dominico, plátano maricongo, all varieties of *M. normalis*; the three latter are so similar to "plátano común" (having only a few more fruits in the bunch), that they may be regarded as one variety — "guineo morado" (*M. sapientium*) — "guineo gigante enano", viz. a dwarf tree with very large fruits (*M. sapientium*), one of the best varieties for cultivation.

The disease known as "el mal del plátano", which is due to *Fusicladium cubense*, is a serious danger to the banana-tree in Porto-Rico. At first the trees grow vigorously, but when the fruiting season approaches, the petioles begin to turn yellow and the leaf-blades assume a chocolate colour and fold in two throughout their length.

Any fruit-bunches produced are usually badly developed, or if owing to the great fertility of the soil, bananas are obtained the first year, no fruit is borne afterwards. The pathogenetic agent lives as a saprophyte in the soil. It is propagated by the seeds or by mechanical distribution. Since it lives in the interior of the tissues, fungicides are of little avail, and recourse must be had to preventive measures.

Few insects attack the banana in Porto Rico and cause no serious injury. The author mentions the "caculo achocolatado" (*Phyllophaga* sp.) which eats the leaves of the banana and of several other plants, and the "vaquita" (*Diaprepes* sp.).

In conclusion he describes the preparation of banana meal, known also as "bananina" or "musarina", and gives various simple recipes for its use.

LIVE STOCK AND BREEDING.

78 - The Effect of Chloropierin Fumes on *Argas reflexus*. — REMY, M. P., in: *Comptes rendus de l'Académie des Sciences*, Vol. 172 (Meeting of June 20), No. 21, pp. 1619-1624. Paris, June 1921.

HYGIENE

Argas reflexus is a parasite causing great mortality in pigeon lofts, and sometimes producing serious affections in man. The destruction of this pest is a very difficult matter, for it can remain without food for several years and none of the insecticides hitherto used are absolutely certain in their effects. This does not apply however to the fumes of chloropierin which have proved to be highly toxic in the case of other insects also (1). The author has found that if *A. reflexus* is exposed to these fumes paralysis ensues which always ends in death. No experiments

(1) See R. Jan. 1920, No. 58. (Ed.)

on a large scale have been made but doses of 20 to 30 gm. per cubic metre seem the most effective. The fumes should be allowed to act all day and if masks are worn there is no danger in the operation. As the hatching period lasts from 8 to 15 days, a second treatment 1 month after the first will be necessary, in order to destroy the mites that have hatched out last.

179 - **The Autopyotherapeutic Treatment of Strangles.** — MONNET, M. (Vétérinaire major), in *Revue Vétérinaire*, Vol. LXXIII, Third Series, Vol. II, pp. 338-344. Toulouse, June 1921.

The excellent results obtained by the pyotherapeutic treatment of contagious lymphangitis in the horse suggested to the author that the same methods might be applicable to strangles which is the chief pyogenic equine disease.

The technique used was a series of autopyotherapeutic injections. The pyovaccine was prepared according to the method described by BELIN, in the *Bulletin de la Société centrale de Médecine vétérinaire*, of Feb. 28, 1919, p. 73.

Injectons were made into the muscles of the central region of the collar at equal distance from the mastoid-humeral, the upper edge of the collar, and the front edge of the shoulder.

This region is first shaven and then disinfected by painting with tincture of iodine.

The injection is made by means of the short needle used for intra-dermo-palpebral maleinage attached to a 5 or 10 cc. Pravaz syringe. The amounts used are as follows: 1) four first doses increasing from 1 cc. — 1.5 cc — 2 cc — 2.5 cc. on the first four days — 2) Two doses of 2.5 cc. on the fifth and sixth days.

The experiments made on 4 mares showed that: strangles can be cured by autopyotherapeutics; this treatment, at all events if the technique described in this work is adopted, is perfectly safe; it seems to check the development of specific inflamed adenoids, but has little perceptible effect upon the course of catarrhal local affections.

180 - **Vaccination of Cattle against Anaplasmosis; the Results of Inoculating High-Class Breeding Animals with Sheep and Goats' Blood infected by Repeated Transmission.** — IAGNIÈRES, J., in *Bulletin de la Société de Pathologie Exotique*, Vol. XIV, No. 8, pp. 459-460. Paris, October 12, 1921.

The author has been able to prove from his experiments in the vaccination of cattle against anaplasmosis, that by using the blood of sheep or goats which has been infected by repeated transmission, strong reactions requiring special treatment, but not necessarily terminating fatally, are produced in pure-blood breeding stock (1).

The natural resistance to *Anaplasma argentinum* conferred upon these cattle by such vaccination is a very important point and has been

(1) See R. April 1920, No. 438. (Ed.)

he subject of careful study on the part of the author. The results hitherto obtained have been very encouraging. In every case the greatest immunity to natural anaplasmosis has been shown by the youngest animals that have been repeatedly inoculated.

An actual proof of the value of such treatment is given by the experience of a large Argentina stock breeder who was willing to expend considerable sums on supplying breeding-cattle for districts infested with piroplasmosis and anaplasmosis. He immunised 200 of these animals in 2 series, adopting the method employed by the author. Six months later he sent for a cow from the infected region and inoculated with the blood of this animal 6 vaccinated cattle and 2 which had not been vaccinated. The latter became seriously ill and one died. Of the 6 vaccinated individuals, 4 bore the treatment very well, in 2 there was a reaction which in one case terminated fatally. Laboratory examination revealed the presence of *Anaplasma argentinum* in the blood corpuscles of all the diseased animals.

This searching test would seem to prove without any possibility of error that the method employed is thoroughly effective.

181 - "Ghedda", or Hemorrhagic Septicemia of the Dromedary. — DONATIEN, A., in *Archives des Instituts Pasteur de l'Afrique du Nord*. Vol. I, No. 3, pp. 242-249. Tunis, 1921.

This is an epizootic disease which must be very wide-spread, being known to the Arabs of numerous tribes as "Ghedda", or under some almost identical name.

From its symptoms and the lesions produced, "ghedda" may be regarded as nearly allied to the forms of hemorrhagic septicemia attacking horses, cattle, sheep, dogs, etc. The probability of this kinship is strengthened by the difficulty or impossibility of transmitting these manifestly contagious diseases by means of inoculation with the humours or organs of infected animals.

Although in other species certain microorganisms, especially *Pasteurella*, have been found to play at least a secondary part, no parasites of this kind have ever been discovered in the case of the camel.

Thus the primary and secondary virus of "ghedda" are still unknown.

182 - Note on the Natural Spirillosis of the Rabbit (*Spirochaeta cuniculi*). —

I. LEVADITI, C. MARIE, A., and NICOLAUS, S., Virulence pour l'homme de la spirillose spontanée du lapin, in *Comptes rendus de l'Académie des Sciences*, Vol. 172, No. 34, (June 13, 1921), pp. 1542-1543, bibliography of 5 works, Paris, 1921. — II. RUPPERT, F. (Mitglied des Staats-instituts für Experimentelle Therapie), Über eine durch *Spirochaeta cuniculi* hervorgerufene kontagiöse Geschlechts-krankheit der Kaninchen (Kaninchen Spirochaetose), in *Berliner Tierärztliche Wochenschrift*, Year XXXV11, No. 42, pp. 493-496, 4 figs. bibliography of 18 works, Berlin, October 20, 1921.

I. — The authors have studied from the microbiological, histological and pathogenetic standpoints a spirochaete disease of the rabbit characterised by scabrous papulae occurring on the reproductive organs and nostrils.

This malady has been recorded in Austria, Germany and Holland. It is produced by a spirochaete with much morphological resemblance to *Treponema pallidum*.

The histological researches and the data connected with this disease have been dealt with in a paper written in collaboration with ISAÏCU (1) and brought before the "Société de Biologie". Experiments have proved that *Spirochaeta cuniculi* is not pathogenetic to man.

II. — Detailed information respecting: the history and etiology of rabbit spirillosis; the morphology of the pathogenetic agent; the results of natural and artificial infection; the symptoms, pathological anatomy and microscopic evidence of the disease. As regards treatment, the author states that good results have been obtained by doses of 0.04 gm. to 0.06 gm. of "Silbersalvarsannatrium" per kg. of live weight.

Rabbits after having been cured, can again contract the disease, which proves they have not acquired immunity.

183 - A Calculation of the Amount of Food necessary for Stock, especially when Grazing, per 500 kg. of Live Weight. — HOLDEFLEISS, P., in *Deutsche Landwirtschaftliche Presse*, Year XLVIII, No. 94, p. 693. Berlin, November 1921.

In order to allow a uniform comparison of the amount of food required by stock, the calculation is based on a live-weight of 500 or 1000 kg.

KÖHN and KELLNER's rationing tables are also based on 500 kg of live-weight. It is however well-known that 500 kg. of live-weight have a significance differing with the size of the animals considered. In practical rationing these conditions are taken into account, maximum or super-maximum amounts being given to small animals, and minimum quantities to large animals. It would be better to use determined numerical proportions; simple coefficients or connection factors could easily be employed in reckoning the ordinary rations. This method is particularly useful in calculating the production of pastures, especially when the animals belong to different species and are of varying sizes.

According to RUBNER and KELLNER the amount of food required is in more direct relation to the body-surface than to the live-weight.

In order to obtain numerical proportions that can be used, the author has devised the following formula where a represents the live-weight in pounds of 500 grams, $Fu a$ represents the amount of food required per head, and 1 the amount necessary for 1000 pounds of live-weight:

$$1 : Fu a = \sqrt[3]{1000^2} : \sqrt[3]{a^2}$$

The cube-root of the live-weight is unity: its square is the ratio

(1) LEVADITI, M. and ISAÏCU, in *Comptes rendus de la Société de Biologie*, Meeting of June 11, 1921.

with the body-surface. The amount of food required for the live-weight is therefore :

$$Fu a = \frac{\sqrt[3]{a^2 \times 1}}{\sqrt[3]{1000^2}}$$

For 1000 pounds of live-weight, the formula is as follows :

$$Fu \times 1000 = \frac{\sqrt[3]{a^2}}{\sqrt[3]{1000^2}} \times \frac{1000}{a} = \frac{10}{\sqrt[3]{a}} = f$$

By giving a increasing values, a decreasing logarithmic series is obtained for the values of f .

TABLE I. — *Correction Coefficients
for the different Values of Live-Weight.*

a Live-Weight in kg.	f Correction Coefficient	a Live-Weight in kg.	f Correction Coefficient
0.5	10.00	200	1.36
1.0	7.94	250	1.26
2.0	6.30	300	1.19
3.0	5.50	350	1.13
4.0	5.00	400	1.08
5.0	4.64	450	1.04
12.5	3.42	500	1.00
25.0	2.72	550	0.97
37.5	2.37	600	0.94
55.0	2.15	650	0.92
62.5	2.00	700	0.89
75.0	1.88	750	0.87
87.5	1.79	800	0.86
100.0	1.07	850	0.84
150.0	1.49	2 850	0.56

The results obtained on multiplying by the coefficients f the values calculated for 500 kg. of live weight, when compared with the figures obtained empirically, have shown that these coefficients may be considered exact within considerable limits.

When it is a question of determining the production of a pasture, the correction by means of these coefficients also gives more accurate results. Table II gives two instances of such a calculation.

TABLE II. — *Calculation of Production of 2 Pastures.*

No. and kind of animals at grass	Average live-weight kg	No of days of grazing	Total production expressed as grazing-days per 500 kg. of live weight		
			Simple calculation	Factor †	Corrected calculation
Pasture I					
5 cows . . .	500	80	400.0	1.00	400.0
2 oxen . . .	700	50	140.0	0.89	124.6
11 calves . . .	300	120	792.0	1.19	942.5
10 sheep . . .	62.50	150	187.5	2.00	375.0
4 colts . . .	350	150	420.0	1.13	474.6
Total . . .	—	—	1 939.5	—	2 316.7
Pasture II					
5 cows . . .	450	80	360.0	1.04	374.4
2 oxen . . .	600	50	120.0	0.94	112.8
14 calves . . .	250	120	840.0	1.26	1 058.4
13 sheep . . .	50	150	195.0	2.15	419.2
4 colts . . .	250	150	300.0	1.26	378.0
Total . . .	—	—	1 815.0	—	2 342.8

If the simple (uncorrected) calculation is taken as the basis, pasture II will have produced less than pasture I, but if the corrections are made by means of the coefficients for the different classes of animals, the production of pasture II is greater than that of pasture I.

184 - **Researches on the Value of Different Processes of Disintegrating Straw (1) in Germany.** — I. HONCAMP, F., Ueber Strohaufschliessung, in *Die Landwirtschaftlichen Versuchs-Stationen*, Vol. XCV, Parts 1-3, pp. 69-89. Berlin, 1919. — II. HANSEN, I., Die Aufschliessung von Stroh mit kalter Natronlauge nach dem Verfahren von BRECKMANN D., in *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, Vol. XXXIV, Part 4, pp. 41-44. Berlin, 1919. — III. HONCAMP, F. and BAUMANN, F., Untersuchungen über den Futterwert des nach verschiedenen Verfahren aufgeschlossenen Strohes, II Mitteilung: Aufschluss des Strohes durch Aetzkalk mit und ohne Druck (Mitteilung der Landwirtschaftlichen Versuchs-Station Rostock), in *Die Landwirtschaftlichen Versuchs-Stationen*, Vol. XCVIII, Parts 1-2, pp. 2-31. Berlin, 1921. — IV. HONCAMP, F., and BAUMANN, F., Untersuchungen über den Futterwert des nach verschiedenen Verfahren aufgeschlossenen Strohes III Mitteilung: Aufschluss des Strohes mit Soda (Mitteilung der landwirtschaftlichen Versuchs-Station Rostock), *Ibidem* Vol. XCVIII, Parts 1-2 pp. 43-63. Berlin, 1921.

I. THE METHODS HITHERTO EMPLOYED IN THE DISINTEGRATION OF STRAW, AND THE CHIEF RESULTS OBTAINED. — The final object of all these methods is to increase the digestibility and forage value of straw

(1) See R., April 1921, No. 406. See also MAGNUS, H., *Theorie und Praxis der Strohaufschliessung* (Aus dem Laboratorium des Kriegsausschusses für Ersatzfutter). Verlagbuchhandlung Paul Parey, Berlin, 1919 and VON WISSEL, Beitrag zur Ermittlung eines einfachen und zuverlässigen Verfahrens die Höhe des Aufschliessungsgrades von Kraftstroh und dergleichen analytisch festzustellen, *Die landwirtschaftlichen Versuchs-Stationen*,

is general by treating it with chemical agents having the power to free the fibre from its surrounding elements, especially lignin, so as to assist the bacteria in breaking up and destroying the cellulose. It is, however, now admitted that the complete removal of the lignin is not necessary in the disintegration of straw, but that it is rather a question of softening the crude fibre and breaking down the strong connection between the lignins and the cellulose. Whereas satisfactory results have been obtained with alkalis and caustic soda, the disintegration of straw by the action of acids was a failure. The researches of PRINGSHEIM and MAGNUS made clear the changes undergone by the straw during its treatment with caustic soda, quick-lime and carbonate of soda. During disintegration with caustic soda, first the silicic acid and then the lignin are removed.

The best method of disintegration is BECKMANN'S, the straw being treated cold with alkalis and under ordinary pressure.

The author carried out a series of feeding experiments using straw that had been disintegrated by the three alkaline processes, and ascertained the loss of crude nutrient substances entailed by the disintegration. The disintegration of straw under pressure with caustic soda caused the destruction of part of the organic matter containing all the groups of nutritive substances.

Disintegrated straw from different species of plants was fed to sheep and its effects compared with crude straw of similar origin.

The straw of autumn cereals lends itself best to disintegration. After treatment with 3.5, or 7 % caustic soda the digestibility of the straw was increased respectively 72 and 94 %.

The results so far obtained may be summarised as follows : the increase in the food value due to disintegration, which shows itself in the increased starch value, is very great in the straw of autumn cereals, but slight in straw from Leguminosae and Cruciferae.

II. DISINTEGRATION OF STRAW BY COLD SODA LYE ACCORDING TO BECKMANN'S PROCESS. — This process, which has been patented, is carried out in the following manner by the "Veredelungsgesellschaft für Nahrungs- und Futtermittel, Bremen and Berlin": chopped straw is

1. XCVI. Parts 5-6, pp. 263-275. Berlin, 1920. — In this contribution to the search for a simple, sure process for the analytic determination of the extent to which the straw had been disintegrated by the treatment ("Kraftstroh") etc., the results obtained by the different processes are given viz.: 1) phloroglucin test; — 2) WEENDE's method — 3) gravimetric method — 4) volumetric method — 5) WOHL's calcium chloride method. The results show that in order to ascertain the extent to which the straw has been disintegrated, it is necessary not only to analyse the straw that has been treated but also the crude straw, and further : disintegration process adopted must also be known. A short description is given of hitherto untested processes invented by: 1) WAENTIG and GIERSCHE (see R. Dec. 1921, 1244) — 2) MACH and LEDERLE, *Die Landwirtschaftlichen Versuchs-Stationen*, Vol. XI, 271, Berlin, 1917 — 3) WILSTÄDTER (see R. Dec. 1921, No. 1244). (Ed.)

placed in flat boxes made of wood or tin (the fixed height being about 50 cm.; the surface area, 2 sq. metres per quintal of straw); 8 times its weight of 1.5-2 % soda lye is then added and allowed to act for 12 hours; the mixture requires stirring from time to time.

The boxes should be put in tiers so that the lye, which is used several times, can be collected and used successively in each of the lower boxes. The alkaline lye can easily be removed from the straw by washing.

FINGERLING has compared the digestibility of straw disintegrated with a cold ("Kaltstroh"), and a hot lye respectively. He obtained the results given in Table I.

TABLE I. — *Comparative Digestibility of Straw disintegrated by COLSMANN and BECKMANN'S Processes.*

Nutritive substances	Straw disintegrated by boiling (COLSMANN process)	Straw disintegrated by cold lye (BECKMANN process)	
		for 3 days	for 12 hours
Organic matter	58.77 %	72.76 %	71.08 %
Nitrogen-free extracts	35.89	79.59	63.55
Fat	—	60.01	84.76
Crude fibre	73.28	70.36	78.86

The author uses a BECKMANN process plant at the Agricultural Institute of the University of Königsberg. The average water consumption is 4.02 cubic metres per quintal of crude straw; this gives an average yield of 4.1 quintals of damp, disintegrated straw containing on an average 16.9 % of dry matter. The loss in dry matter was 22.4 % instead of 37.16 %, as is the case with the COLSMANN process.

It takes 20.8 litres of cold soda lye to disintegrate 100 kg. of crude straw, but 16 litres of boiling lye are sufficient. The content of digestible nutritive substances determined by the author is given in Table II.

HANSEN has also made experiments to find out the food value of straw disintegrated with a cold lye and a boiling lye respectively. It was impossible to make accurate determinations in the case of horses (which prefer straw that has been disintegrated with cold lye), on account of the nature of their performance. On the other hand accurate experiments were carried out for 3 months with milch cows. The deviations observed in milk yield and fat production were very slight.

HANSEN found from his experiments that disintegration for 3 days with cold lye gives to rye straw a nutritive value equivalent to that resulting from treatment with boiling lye according to COLSMANN'S process. Cold disintegration has also this additional advantage over boiling, that it can be carried out on any agricultural farm possessing a silage

ient water supply, for the plant required is very simple and much less expensive than that used in the COLSMANN process.

TABLE II. — *Digestible Nutritive Substance Content of Straw disintegrated with Cold Lye ("Kallstroh").*

Nutritive substances	Straw disintegrated by cold lye		Dry matter of disintegrated straw	
	treated for 3 days	treated for 12 hours	treated for 3 days	treated for 12 hours
Dry matter	16.29 %	16.81 %	100 %	100 %
Nitrogen-free extracts . . .	4.18	4.63	25.59	27.54
Crude fat	0.18	0.19	1.10	1.11
Crude fibre	6.66	6.44	40.93	38.32
Starch value	9.50	9.72	58.32	57.79

III. DISINTEGRATION OF STRAW WITH MILK OF LIME BOTH WITH AND WITHOUT PRESSURE. — The experiments of the authors have demonstrated that the disintegration of straw by milk of lime also causes greater losses of organic matter when the process is carried out under pressure than when no pressure is applied. The fibre does not appear to be attacked. With this process the amount of investing substances removed (lignin - silicic acid) is less than when caustic soda is used, but as the proportion of the organic matter and especially the crude fibre is almost as large in the resulting product as in straw that has been disintegrated by soda, it is evident that the amount of lignin present in a disintegrated straw is not an exact measure of the extent to which the process has been carried out.

The starch value of straw disintegrated by quick-lime is much superior to that of crude straw, being in the first case 48.68, and in the second 13.29.

The above shows that disintegration with lime with or without pressure increases the food value of the straw almost as much as treatment with caustic soda.

The damp, disintegrated straw was eaten by the stock without any bad effects, no digestive disturbances being observed. The lignin was completely undigested. The digested portion of the crude fibre, as determined by the methods of WEENDE and CROSS, had almost the same composition as refined fibre.

IV. DISINTEGRATION OF STRAW WITH CARBONATE OF SODA. — The straw is boiled for 3 hours with 8 times its weight of an 8 % solution of carbonate of soda, just as in the cases where quick-lime or lime is used. The fibre is not attacked, but the pentosans are probably much affected.

Experiments in feeding sheep on rye-straw disintegrated by boiling

with 8 % milk of lime under pressure for 5 hours and with carbonate of soda of the same concentration, but for a shorter time, have shown that the latter process is the more effective. The respective digestibility coefficients of the rye straw in either case are given in Table III.

TABLE III. — *Digestibility coefficients of rye-straw disintegrated with lime and carbonate of soda respectively.*

	Disintegration with lime	Disintegration with carbonate of soda
Organic matter	53.4 %	60.6 %
Nitrogen-free extracts	32.2	41.0
Crude fibre	75.7	80.2

The starch value of the straw disintegrated by lime was 47.1, whereas that of the straw treated with carbonate of soda was as high as 55.6.

The crude fibre estimated by CROSS differed from that determined by WEENDE'S method in having almost the same composition as pure fibre. In the same manner the digested portion of CROSS'S crude fibre was entirely similar in composition to the digested portion of the pure fibre.

185 — **Researches Made in the United States on the Sodium Chloride Content of Stock Feeds.** — FRAPS, G. S. and LOMANTZ, S., in *Texas Agricultural Experiment Station* (Division of Chemistry), *Bulletin* No. 271, pp. 5-14. College Station Texas, October, 1920.

In estimating the sodium chloride content of a mixed feed, it is necessary to know the amount of this substance in the ingredients used. The sodium chloride content of a mixture can be calculated either from the average composition, or from the maximum of each of the ingredients. The excess of salt found over that calculated is to be regarded as due to an addition.

The authors have determined the chloride content (expressed as sodium chloride) in a number of feeds by the method of incineration in the presence of sodium carbonate. As the Official A. O. A. C. (Association of Official Agricultural Chemists), method was too lengthy for examining a large number of feeds, the authors tried a more rapid method (which they describe in detail), giving results that agreed well with the official system.

The following Table shows that all unmixed feeds except lucerne, molasses and some meat products are low in chlorides.

An approximate method for estimating the added salt in a mixed feed is to subtract 1 % of the sum of the lucerne and molasses from the salt content calculated to sodium chloride, or better still, by comparison with the sodium chloride averages obtained for the ingredients of the feed.

TABLE.

Feeds	No. of samples	Minimum	Maximum	Average
Lucerne Hay (western)	14	0.42	1.89	0.98
Chopped Barley	21	0.10	0.26	0.16
Velvet Beans	6	0.01	0.04	0.03
Dried Beet Pulp	3	0.37	1.47	0.87
Dried blood	1	0.75	—	0.75
Dried Brewers' Grains	3	0.04	0.06	0.05
Cocoanut meal or cake	14	0.84	1.73	1.11
Maize bran	15	0.06	0.17	0.10
Chopped maize	20	0.08	0.13	0.09
Maize feed meal	3	0.08	0.11	0.10
Ground maize and cobs	3	0.12	0.23	0.16
Chopped ear maize with sheaths	3	0.11	0.21	0.15
Cold-pressed cotton seed or meal	15	0.05	0.16	0.07
Ordinary cotton seed meal or cake	29	0.05	0.15	0.07
Prime cotton-seed meal or cake	9	0.05	0.08	0.06
Broken or ground cottonseed meal or cake	3	0.06	0.10	0.08
Peterita (var. of sorghum)	3	0.11	0.19	0.15
Fish meal	3	0.48	0.76	0.57
Graham Flour	1	0.12	—	0.12
Rye Flour	1	0.13	—	0.13
Hominy Feed (maize bran and gluten ground together)	19	0.06	0.30	0.12
Chopped Kafir (var. of sorghum)	2	0.06	0.07	0.07
Kafir (head stems)	1	0.13	—	0.13
Linseed meal	5	0.04	0.06	0.05
Meat meal	2	2.58	2.95	2.17
Meat scraps	8	0.58	1.91	1.31
Chopped milo (var. of sorghum)	13	0.07	0.15	0.10
Milo Head chopped or Ground	3	0.13	0.15	0.14
Molasses	14	0.90	1.35	1.12
Ground Oats	15	0.09	0.24	0.14
Rolled Oats	2	0.09	0.17	0.13
Chopped Oats	1	0.19	—	0.19
Ground Oat Hulls	2	0.10	0.15	0.13
Pea-nut Feed No. 4	4	0.05	0.15	0.08
Pea-nut Hulls	3	0.08	0.09	0.08
Prime Pea-nut meal or Cake	2	0.04	0.06	0.05
Ordinary Pea-nut meal or Cake	8	0.04	0.17	0.06
Pea-nut Stems	1	0.20	—	0.20
Pea-nuts whole pressed	6	0.03	0.10	0.06
Rice Bran	31	0.08	0.19	0.11
Cracked Rough Rice	7	0.10	—	0.10
Rice Hulls	1	0.13	—	—
Chopped Rye	1	0.13	—	0.13
Ground Screenings	1	0.41	—	0.41
Sorghum Fodder	1	0.08	—	0.08

This investigation is important from the point of view of the soft pork question from peanut fed animals. It suggests that if both liquid and solid fat were fed at the same time, greater proportion of liquid fat would be used to meet the energy requirements of the body, and this would make it possible to overcome the softness of the pork of peanut fed hogs.

Results obtained in the spring indicated that it is preferable to feed the peanuts with other feeds for 70 days rather than to feed for 40 days with peanuts alone and then to finish with other feeds.

The author intends to repeat this work, using pigs as his subjects instead of rabbits.

188 - **The Dongolao Horse.** — TARANTINO, G. B. (Osservatorio zootecnico della Colonia Eritrea), in *Allevamenti*, Year II, No. 7, pp. 196-198, figs. 5, No. 8, pp. 231-232, figs. 2. Palermo, July 1, 1921, August 1, 1921.

HORSES

In Eritrea and especially at Hamasien excellent horses used formerly to be bred. At the present time, horse-breeding is no longer practised and horses are imported, the greater number coming from Abyssinia and specially from Tigrai. Two horse-breeding attempts made by the Italian Government in 1903 at Godofelassi, and in 1918-1919 at Sahel (Nacfa) were unsuccessful. In the districts of Barca, Gasc and Setit, which are the most suited to horse production, there are a few private stud-stations belonging to the Chiefs of the tribe.

The main cause of the almost complete disappearance of horse-breeding in Eritrea is the prevalence of horse-pest. The author states, however, that this disease could easily be prevented by the help of well-directed prophylaxis.

The horse bred in Eritrea and in general throughout Abyssinia, is of the Dongolao or Dongolaw type, so called from Dongola, its place of origin the northern portion of Nubia and the Sudan. It is clearly distinct from the eastern type and is probably the result of a very old cross between native and western breeds. The Dongolao is a luxury horse and highly prized. Its conformation is good, but the joints are weakened by the practice of hobbling from earliest youth whenever they are turned out. The measurements taken by the author were as follows: height at withers 1.45 m., height at croup 1.45 m., height at cannon bone 0.45 m., length of head 0.54 m., length of neck (sinciput withers) 0.87 m., length of neck (throat-chest) 0.57 m., circumference of thorax 1.10 m., circumference of abdomen (umbilicus) 1.26 m., length of trunk (point of shoulder to croup) 1.05 m., width of croup 0.48 m., distance between the shoulders 0.48 m., length of shoulder 0.61 m., circumference of knee 0.30 m., circumference of hock 0.37 m., circumference of cannon-bone 0.18 m.

The Dongolao is exclusively a saddle-horse. The methods of breeding leave much to be desired. The stallions and broodmares do not receive the care necessary and the colt sucks its dam for 40 to 60 days and is also given cows' or camels' milk. When about 2 years old, a child is put on its back and the animal is led to the pasture or watering-place, two of its feet being hobbled laterally or diagonally in order to accustom it to amble.

When it is about 30 months old, it is mounted by a good rider.

The author describes the various components of the harness of the Dongolao horse and concludes by expressing the hope that the Government will take measures to arrest the retrograde movement in the breeding of this fine animal. This could be done by choosing Arab sires, by constructing shelters to protect the horses during the night from the attacks of many insects that spread diseases, and by feeding rather more liberal rations of barley or doura.

189 - **Essay on the Depreciation in the Market Value of Broken-Kneed-Horses.** - NICOLAS, E., in *Recueil de Médecine Vétérinaire*, Vol. XCVII, No. 20, pp. 399-407. Allfort, October, 1921.

The disputed claims that frequently have to be adjudged in this connection are of considerable importance on the economic side, and very difficult to settle on account of the small amount of assistance given by writers on the subject.

The losses the third party responsible for the accident is required to make good are of two kinds: 1) *Remediable injury*: feeding, cost of treatment, and if necessary, the expense of replacing the animal. The assessment of these damages generally comes within the scope of the judicial police and can usually be made without difficulty. — 2) *the loss due to the depreciation of the animal* should the accident have left any definite mischief or sequelae. This is where the difficulty begins. How far has the owner a right to compensation for this depreciation in the value of his horse?

The author has studied the reason for the depreciation of the broken-kneed horse, and finds it may be ascribed to the three following causes which he examines separately: 1) functional trouble, 2) possible weakness of limbs and predisposition to falling; 3) unsightly nature of the scar.

1) *Functional trouble.* — This is relatively rare. Where it exists, it gives rise to lameness and the economic loss must be estimated under this head.

2) *Possible weakness of the legs and predisposition to further falls.* — This point holds good for all horses no matter to what category they belong. It is obvious however that its importance varies with the class of animal, since the consequences of another fall should it occur, would be very different in the cases of a saddle-horse, a post-horse or draught horse. It may therefore be said that the consequences to be feared in the case of a broken-kneed horse are proportionate to mV^2 . If the relative values of V are determined for galloping, trotting and walking, the necessary data for judging the depreciation caused are obtained. Thus, calculated as a function of the height H of horses, these values are, according to the authorities on the subject (1) $\frac{3}{4}$ (no work); $\frac{6}{4}$ (trotting); $\frac{9}{4}$ (galloping) or as 1 : 2 : 3, and their squares as 1 : 4 : 9.

The author, in calculating the depreciation on the case of the three

(1) DECHAMBRE, *Traité de zootechnie*, Vol. I, p. 350. (Author's note)

classes of horses, devised the following general formula summarising the total depreciation incurred by a broken-kneed horse (2).

$$\text{Depreciation} = \frac{\left(Vba - \left[P \times p \times \frac{10}{8} \right] \right) V^2}{9}$$

As is seen, the horses are grouped in 3 categories according to the use that is generally made of them (and hence according to their paces and speed), which may be characterised by 3 types: 1) the saddle-horse of which the pace is a gallop; 2) the post horse which trots; 3) the draught horse which walks. These types depend to some extent on the same principle as the assessment of the depreciation and are its logical outcome. As the value of the horse before the accident forms part of the depreciation formula, the depreciation cannot be out of proportion to the worth of the animal. A horse of 500 kg. and bought for 1560 francs, whether a riding or driving horse, a trotter or walker, will be depreciated to the same ultimate extent, according to the formula, if the price of horse-meat is 2.50 fr., which is perfectly just, as the meat has not decreased in value, and therefore cannot have become depreciated. Reciprocally, the most valuable horses are most depreciated by such an accident.

3) *Unightly nature of the scar.* — This is only of importance in the case of the riding or driving horse. A broken-kneed animal cannot be used for either purpose, for it is blenished, and must sink to the level of a rejected horse. Its value is given by the following formula:

$$\text{Depreciation} = Vba - \left(P \times p \times \frac{10}{8} \right)$$

Depreciations are not cumulative, one excludes another, and it is the most important that is taken into account. Thus a horse loses nothing more of its value by breaking its knees a second time, unless the second fall produces some functional trouble that did not exist before, in which case the depreciation is estimated for lameness.

In short it is clear that if the owner claims a given sum as damages, the expert will only acquiesce if this is below the amount of depreciation which would logically follow from his deductions. The expert will however explain his views to the judge, so that he may understand that the opinion depends upon sound reasoning.

190 - Comparative Feeding Value of Sunflower Silage and Darso Silage for Fattening Baby Beef during the Final Stage of Fattening. Experiments in the United States. — BLIZZARD, W. L., in *Oklahoma Agricultural and Mechanical College, Agricultural Experiment Station, Bulletin No. 131*, pp. 3-7. Stillwater, Sept. 1920.

CATTLE

Experiments covering a period of 150 days conducted at the U. S. Indian School at Chilocco (Oklahoma), with 14 calves registered Hereford ♂ × Shorthorn ♀ (high grade). These animals were calved the previous

(2) The coefficient 10 which is obtained from the work capital and the flesh capital of a rejected horse may vary with the season and the place. (Authors' note.)

spring, weaned in October and divided into two lots; each receiving a ration of ground maize, cottonseed meal, and lucerne hay, but Lot I received in addition sunflower silage, and Lot II, darso (sorghum var. silage).

The average percentage composition of sunflower and darso silage is shown as follows, respectively: water 71.96 and 73.11; ash, 3.23 and 1.54; protein, 2.96 and 1.91; fibre 8.67 and 6.46; nitrogen free extract 12.36 and 16.65; fat 0.81 and 0.34.

The results of these experiments (January 16 to June 17, 1920) are collected in the appended table.

These results indicate that darso silage combined with the given ration, has proved to be practically equal in value to sunflower silage for encouraging beef production.

Results of Feeding Test.

	Lot I 7 animals	Lot II 7 animals
	lb.	lb.
Feed consumed per day per head . . .		
Ground maize	11.00	11
Cotton seed meal	1.07	1.07
Sunflower silage	13.00	—
Darso silage	—	13.00
Alfalfa hay	2.00	2.00
Initial weight	2996.00	2971.00
Average initial weight	428.00	424.00
Final weight	5348.00	5382.00
Average final weight	763.00	769.00
Total gain	2377.00	2411.00
Gain per head	335.00	345.00
Average daily gain per head	2.24	2.29
Initial cost per head	36.71\$	36.43\$
Initial cost per group	257.00\$	255.00\$

191 - Effect of Shelter and Temperature of the Drinking Water on the Increase in Weight of Fattening Cattle (1) Experiments in the United States. — POTTER, E. L., and WHITCOMBE, R., in *Oregon Agricultural College Experiment Station, Eastern Oregon Branch Station, Bulletin No. 183*, pp. 5-11, Corvallis, Oregon, Sept. 1921.

Experiments conducted over a period of several years at the Eastern Oregon Branch Station with cattle and dairy cows have shown that fattening cattle, fed under shelter and having access to a paddock, consume a quantity of feed equal to that consumed by animals reared in the field, and the actual gain established is comparatively negligible. The results obtained with fattening dairy cows indicated no noticeable difference whatever.

As regards the effect of the temperature of the water, results obtained with cattle stock showed that the effect is practically nil both with reference to food consumption and to increase in weight.

[191-192]

92 - **The Gascon and Lauraguaise Breeds of Pigs in France.** — GIRARD, Les races porcines méridionales, in *Revue Vétérinaire*, Vol. LXXIII, 3rd series, Vol. II, pp. 82-95 and 466-485. Toulouse, February and April, 1921.

It is estimated that there are over 1 200 000 adult pigs in the south of France which are unequally distributed among the 12 departments forming the secondary basins of the Aude and the Adour. These animals may be black or white, but are most commonly piebald; they form more than one-fifth of the total number of pigs in the country. The pigs of the south of France, unlike those of the North, all belong to the type with pointed snout and horizontal ears known as the "mole-headed or circum-mediterranean breed" living in Africa, and also found in Spain, Portugal, Italy and the whole of South and Central Europe. Some are pure-bred animals, others are the results of crossing the mole-headed race with English pigs or white Celtic breeds.

Taken as a whole they form a large and very distinct ethnical group, in which 5 chief races can be distinguished: the *Gasconne*, *Lauraguaise*, *du Quercy*, *Pyrénéenne* and *Périgourdine* or *Limousine* with 2 sub-races or varieties: the *Mièlan* and the *Cazère*. The author while proposing to provide a detailed description of the history, habitat, centres of production, and also of the morphological and physiological characters of these breeds, deals in this paper first with the Gascon and with the Lauraguaise breeds, reserving the other for future publications.

THE GASCON BREED OF PIGS. — This race is now quartered at Nebouzon, a small district of Gascony enclosed by Armagnac, Couserans, Comminges, and Lomagne. Its economic capital, Boulogne-sur-Gesse, has become the centre of the production and the chief market for this breed, which although rather late in developing, is much prized and sought after, on account of its resistance to disease and the quality of its meat.

The breed is very ancient, not yet officially recognised but probably indigenous, and the original stock of all the above mentioned races, as it dates back to prehistoric times. In any case this pig has always been found both in the French and Spanish Pyrenees and its colour was always black.

The adult animal is about 0.75 m. in height (the hind quarters slightly exceed this measurement). At a year old its weight varies around 100 kg., being 150 kg. when it is 18 months old, 200 kg. at 2 years, and may reach 250 or even 300 kg., in the case of fattened animals when 30 months old: some show specimens have weighed over 350 kg.

The Gascon pig is entirely black, its skin is completely and heavily pigmented, the bristles are black throughout their length, the snout and hoofs are black without a trace of any other colour. Any white or grey markings are a proof of crossing with white English breeds, or with the Craonnaise, and disqualify the animals for breeding purposes.

The frame-work of these pigs is strong without being heavy. The skin is thick and coarse but flexible, and is covered with long stiff hairs distributed differently in the various parts of the body, but always allowing

(1) See R. April 1912, No. 682. (Editor Note)

the brown skin with its copper-coloured lights to show through. There is no dewlap or tuft. Many of the animals have on their necks, between the shoulders and the beginning of the back, tufts of longer and stronger bristles pointed in the reverse direction and forming rosettes or brushes. Such animals are much in request with pig-breeders, who declare that they are more resistant than others to changes of temperature, especially to heat.

The limbs of these swine are light and at the same time solid, indicating a strong animal and a good walker. The framework and conformation are regular, showing the type to be eumetric, rectilinear, with medium lines, though possessing a slight tendency to elongation; the body is somewhat compressed, and the outline a little irregular at the withers and hump.

The head is narrow, clearly truncated and very long, especially in the facial portion, which is straight and pointed, terminating in a small, solid, very mobile snout specially adapted to rooting in the ground. The ears are of average length, rather thin, somewhat narrow, close together at the base, and slightly divergent for the rest of their length, carried horizontally or slightly drooping, so as to form a pent-house above the eyes.

Taken altogether, the head is narrow and the outline both above and below is nearly straight thus imparting to the face its characteristic shape of a truncated cone or "moles' head".

The neck is long and fat, compressed in the region of the throat and without dewlap. The upper portion is slender and straight; it is rather narrow where it joins the shoulders but always very muscular.

The body is almost cylindrical, slightly elongated beneath the dorso-lumbar line which is distinctly straight. The chest is always a little narrow, the hind quarters on the other hand are short, oval, and broad, terminating in a fleshy well-rounded ham; the strongly developed crural masses give the hinder parts of the fattened pig the appearance known as "colt-rumped".

The abdomen is generally well-supported and round. The tail should be long strong and covered to the tip with short hairs, large at the base, tapering at the point and terminating in a tassel of long coarse hair, curly in young pigs, and straight and pendent in fat adult animals.

The height and conformation of the pigs vary greatly according to the districts where they are reared and the breeding conditions. As a rule, they are a good criterion of the fertility of the soil. The average morphological type as represented by a boar 18 months old may be described as follows:

Height at withers	0.75 m.	Width of chest	0.35 m.
Height of back	0.78 "	Height of chest	0.40 "
Height at croup	0.74 "	Width of croup	0.35 "
Length of body	1.20 "	Length of ears	0.20 "
Length of head	0.40 "	Width of ears (at base) . .	0.10 "
Length of croup	0.35 "	Average length of hair . .	0.06 "

The sow is always a little lower, flatter and longer.

Fattened animals are nearer the ground, more thick-set and rounder;

they have a larger collar and wider croup; the line of the back is straighter, sometimes interrupted in the middle.

It is noticeable that after the age of 18 months the Gascon pig increases little in height and length; it simply puts on fat which is deposited in a layer under the skin. This layer of fat may become 15 cm. thick on the back and chest, which makes the animals look thick-set and shorter.

The Gascon breed is hardy, vigorous and very prolific, but matures late. These pigs turn to excellent account the liberal rations that may be given them. When well-fed from the first, and comfortably housed in healthy, clean piggeries, the animals grow quickly and furnish a large amount of good meat from the age of 10 months. As a general rule, however, they do not fatten easily until they are 2 years old.

The only food they are given are potatoes and maize (especially the latter), mixed with pig-wash, scalded bran or crushed boiled beans. It is reckoned that, during the 3 months of fattening, the pig consumes 5 hectolitres of maize and gains about 80 kg. in weight, viz., a little less than one kilo a day.

The breed has the great merit of providing for family use the type of butcher's animal that is becoming rare in France.

The Gascon pig, when well fattened, satisfies all the requirements of the peasant consumption of the district.

Its yield is fairly high, being as much as 85 %. It gives a large proportion of very delicate fat, strong intestines and much blood (10-12 kg.). This pig is therefore very useful to the pork-butcher, and to the house-wife. The meat is excellent, of a fine red colour, very firm though tender, nutritious and of good flavour. The two elements constituting fat meat are distinct in this pig; the fat is little dispersed and the meat is close; nearly all the fat is in a covering layer and there is a good supply of lard. These qualities are much prized by the southern peasants who expect the pig to provide them, not only with a stock-pot, the basis of their food supply, but also with the fat required for cooking.

II. LAURAGUAISE BREED OF PIGS. — This breed deserves mention among the chief races in the South, for it is of ancient native origin and still makes its influence felt, as in the past, upon pig-breeding in the south of France. It is a near relative and cousin-german of the Gascon race, but only numbers 200 000 animals, all of which are confined to the upper basin of the Garonne. This pig is a product of the two great types, the *Iberian* and the *Celtic*, a little *Asiatic* blood having been introduced by crossing with English breeds. Its special well-defined characters due to the adaptations necessitated by the climatic and cultural conditions of the country have raised it to the position of a distinct breed. The evolution of this breed is described in detail in the author's long account of its history.

At the present time, the Lauraguaise breed which is derived from the *Iberian* and *Celtic* types, with some admixture of qualities borrowed from the Large Yorkshire, can be described as follows: tall, completely white, long but rather inclined to heaviness, frame strong, convex-linear, a little heavy and unsymmetrical, with "mole head", rather heavy semi-long

and semi-pendent ears. The average height of the adult animal is 0.80 m. but it varies from 0.05 m. to 0.08 m. in either direction according to the sex. The piglings of this breed which are fatter and longer when farrowed than those of other races, generally weigh 20 kg. when they are weaned (at the age of 2 $\frac{1}{2}$ months). When sold at about 4 months old, their average weight is 35 kg, and under ordinary conditions they easily weigh 60 kg when they reach 6 months. When 1 year old boars weigh 125 kg. and sows from 90 to 100 kg; after attaining their full development both weigh 200 or even 250 kg, and after fattening, may turn the scale at 350 kg.

As was said above, these pigs are quite white. The skin is completely without pigment, and is of a yellowish-white free from spots or lights. A few brown or bluish spots are not infrequent on the head or croup, but the breeders are doing their best to eliminate them.

The coarse, long, thick hair which grows freely on the withers, neck and lower portions of the limbs is of a dirty white and assumes a yellowish tinge in old animals.

The head is strong and always a little heavy. One of the chief characters of the Lauraguaise pig is the great development of the frame while the animal is still young. The boar is very large and massive with strong robust frame, well developed forelimbs, rather light hind limbs, wide, deep chest, relatively small abdomen, almost bent upwards at its posterior end.

The sow on the contrary although finer and narrower in front is remarkable for its great length of pelvis, broad quarters and prolapsed abdomen which sometimes in spite of its long legs almost sweeps the ground.

The animals of both sexes are specially noted for length of shoulders, width of chest and great development of the croup, which confer not only considerable weight, but also great body length. This may be as much as 2 metres in breeding-animals, if measured from the snout to the root of the tail. Many good specimens measure 0.90 m. at shoulder height, 1.55 m. around the chest, and 1.60 m. in length from the neck to the root of the tail.

The head is strong, somewhat heavy, narrow, and dry, a little overweighted by the ears, the profile is slightly receding, betraying a cross with the Celtic breed.

The skull is short, rather wide, with prominent occipital region and flat forehead. The face is flat, and forms a regular truncated cone, carrying a slender but very strong snout eminently adapted for rooting in the ground. The neck, which is thin at the point of attachment to the head, is very thick at its insertion on the trunk; it is muscular, very mobile and somewhat long.

Other details are given as to the body of this pig, which is well-fitted for a meat-producing animal. Its legs are also described. The two chief physiological merits of this breed which find favour with the agriculturists of the south and are the cause of its persistence in the region, are its fecundity and hardiness. The boars and sows are equally fertile and the Lauraguaise pig is strong and docile, well-adapted to sudden changes of temperature and to strong winds. It is easy to keep and a good forager.

From the economic point of view, the merits of this pig are the outcome of its origin, its conformation and its rearing. The animals grow large and fatten easily, but they do not show these qualities, at least under ordinary conditions, until they are fairly old, usually when about 12 or 14 months old.

The Lauraguaise breed thus represent a type of pig well suited to the requirements and condition of Southern countries, and though it is not perfect, nor even the best race of the region, it yet deserves to be more extensively kept.

193 - **Use of Forage Crops in the Fattening of Pigs. Experiments in the United States** (1). — ROBINSON, W. L., in *Ohio Agricultural Experiment Station, Bulletin* No. 343, pp. 165-222. tables 24 + figs. Wooster, Ohio, June 1921.

Experiments conducted from 1912-1918 with chiefly purebred Duroc Jersey pigs, farrowed in March and April.

Their object was to gain a knowledge of the most appropriate methods of supplementary feeding for pigs on forage. In most cases one or more groups of pigs were kept on the "dry lot" system for control purposes in order to determine the weight and economic value of the pasture crops.

Table I summarises the results of experiments made on clover pasture.

In a further experiment, the pigs were pastured on blue grass (*Poa pratensis*) with a certain amount of white clover; self-fed maize and tankage was given separately. The pigs thus treated gained at the rate of 1.16 to 1.15 lb. daily per head; and per 100 lb. of gain, consumed 320.6 and 321.5 of maize and tankage respectively.

A number of experiments were conducted with rape pasture. The results of several are summarised in Table II.

Three experiments (Nos. 11, 12, 13) were made with pigs weighing respectively 99; 79; and 68 lb. pastured on rape with a supplementary feed of shelled maize + tankage, in order to compare the self-feeding with hand-feeding. The self-fed lots gained weight more rapidly than the hand-fed, although in 2 experiments with younger pigs, the hand-fed lots showed a gain.

In experiment 7 on rape pasture, a comparison was made between the effect of feeding with maize alone and self-fed maize and tankage given separately but in the same feeding. The pigs self-fed gained weight the most rapidly and at lower cost.

In experiment 7, on rape pasture, comparisons were made between full and limited supplementary rations. For the first 4 weeks, the ration consisted of middlings and tankage, ratio 14:1. This was followed by 17 weeks of hominy feed in place of middlings. For the pigs on full feed the average daily gain was 1.257 lb.; on approximately 2 lb. of concentrates daily per 100 lb. of live weight, 1.065 lb.; on an increased ration of 1

(1) See R. Sept. 1915, No. 942; R. July 1916, No. 780; R. Oct. 1916, No. 1103; R. July-Sept. No. 957; R. Oct.-Dec. 1919, No. 1107; R. Feb. 1920, No. 236; R. Nov.-Dec. 1920, No. 1175. (Ed.)

TABLE I. — *Comparison of Methods of Feeding Maize and Tankage to Pigs on Red Clover Pasture.*

Experiment	Method of feeding maize and tankage	Ratio of Maize to Tankage	Ration per 10 lbs weight	Initial weight per head	Length of test	Daily gain per head	Consumed per pound of gain		Gain accredited to an acre
							Maize	Tankage	
			lb	lb	Weeks	lb	lb	lb	lb
1	No tankage, full feed of maize	—	3.67	34.4	18	0.80	3.88	—	55
	Free choice	10:1	3.89	34.2	18	1.32	3.15	0.30	110
	Full feed, hand feed. . .	19:1	3.79	34.9	18	1.28	3.25	0.17	519
	Three-quarters of a full feed	19:1	3.39	34.3	18	1.01	3.13	0.16	431
	Ditto 12 weeks; full feed 6 weeks	19:1	3.54	34.5	18	1.14	3.14	0.17	537
2	No tankage; full feed of maize	—	4.16	43.8	18	1.16	4.18	—	41
	Free choice	23:1	4.28	42.6	18	1.40	3.84	0.16	110
	Full feed	19:1	4.45	43.5	18	1.47	3.89	0.20	8
3 ⁽¹⁾	Full feed, hand fed. . .	15:1	4.19	48.4	12	1.03	3.48	0.24	374
	3 per cent. ration. . . .	15:1	2.93	48.1	12	0.62	3.28	0.22	220
	2 per cent. ration	16:1	1.93	48.3	12	0.50	2.51	0.16	212

(1) In experiment 3 the proportion of maize in the rations was progressively increased.

TABLE II. — *Comparison of Methods of Feeding Maize and Tankage to Pigs on Rape Pasture.*

Experiment	Method of feeding maize and tankage	Ratio Maize to tankage	Rations per 100 lbs weight	Initial weight per head	Length of test	Daily gain per head	Consumed per lb of gain		Gain accredited to an acre
							Maize	Tankage	
			lb	lb	Weeks	lb	lb	lb	lb
4	Limited maize; no tankage	—	3.30	51.0	12	0.88	3.29	—	268
	Four fifths of a full feed	9 : 1	3.60	52.1	12	1.18	2.79	0.31	(1)
5	Full feed.	14 : 1	4.21	39.9	15	1.26	3.30	0.24	(1)
	2% ration; later full feed.	14 : 1	3.30	40.6	15	1.12	2.73	0.19	(1)
6	3% ration throughout . .	14 : 1	2.88	52.1	15	1.08	2.70	0.19	(1)
	2% ration; later full feed.	14 : 1	3.09	52.3	15	1.22	2.75	0.20	(1)
8	Full feed of maize; no tankage	—	4.11	35.3	18	0.88	4.23	—	366
	Increasing feed of maize; no tankage	—	3.09	34.8	18	0.63	3.66	—	339
	Full feed	19 : 1	3.89	36.4	18	1.06	3.61	0.19	625
	2% ration; later full feed.	19 : 1	3.19	35.2	18	0.85	3.10	0.16	441
	Full feed	9 : 1	4.01	35.1	18	1.10	3.42	0.38	430
	2% ration; later full feed.	9 : 1	2.90	35.0	18	0.95	2.60	0.29	517

(1) Not computed, as no check groups were fed in the dry lot.

to 3 lb. of concentrates daily per 100 lb. live weight, 0.721 lb.; on 1 lb. of concentrates per 100 lb. live weight, 0.428 lb. The control lot, not on pasture, i. e. the full feed dry lot, showed an average daily gain of 1.031 lb. The limited concentrated rations were of economic advantage, but the average weight of those slaughtered was less.

In experiment 9, a comparison was made between the full and limited feeding on soyabean pasture. The lots given maize alone, full-fed, showed an average daily gain of 1.029 lb. per head; as against 1.022 for those which received $\frac{1}{2}$ of the full feed. The first lot consumed 4.348 lb. and the second 3.427 lb. of concentrates per 100 lb. weight. Another lot which was given a full feed + tankage, ratio 9:1, showed an average daily gain of 1.177 lb. per head, and consumed 4.238 lb. of concentrates daily per 100 lb. weight. Yet another lot received $\frac{4}{5}$ of the preceding feed and showed an average daily gain of 1.004 lb. per head and consumed 3.605 lb. of concentrates daily per 100 lb. weight.

Still further experiments were made (Nos. 14, 15, 16) to compare the relative effects of pastures composed of various forage plants to ascertain the value of:— (1) field peas and oats; 2) peas and rape; 3) rape and oats; 4) oats and soybean; 5) rape alone. It was noted that the rape alone furnished green feed for a longer period than the mixtures.

In experiment 17 a comparison between sweet clover and soybean pasture showed that the pigs found the sweet clover unpalatable.

194 - First Egg-Laying Competition in France. — *Revue de Zootechnie* (1) Year 1, No. 1, pp. 85-87, figs. 2. Paris, October, 1921.

The first French Egg-laying Competition was held in 1920-1921, at Vaulx-de-Cernay.

The results were rather poor as was to be expected from hens which were mostly from poultry-yards where it had not been possible to select for egg-production.

The lots of fowls placed in the highest classes at the end of the competition were as follows.

French Light Breeds. — Lot No. 11 (6 hens) laid 632 eggs of the average

(1) The object of this Review, which is the organ of the French "Office d'Élevage" annexed to the national centre of Experimental Stock-Breeding at Vaulx-de-Cernay, is to form a link between: 1) French and foreign stock-breeding researches; 2) Scientific workers and stock-breeders; 3) stockbreeders themselves; 4) French stockbreeders and their foreign customers. The Directors: M. DÉCHAMBRE, Professor of Zootechnique at the Ecole nationale d'Agriculture at Grignon, and the "Ecole nationale vétérinaire d'Alfort" and M. VOITELIER, Professor of zootechnique, at the "Institut National Agronomique de Paris" described the programme (which includes amongst other subjects, summaries of the results of experiments, accounts of scientific researches: practical observations on animal production; bibliographical reviews, etc.), as follows: "An account of the work of the 'Offices agricoles', reports of competitions and shows, the publication of the quotations of the chief markets with numerous illustrations explanatory of the text, together with information of a technical nature and useful suggestions as to the means of making stock-breeding in France profitable".

[193-194]

eight of 55 gm. The best hen in this class (a Gascon fowl), laid 186 eggs weighing on an average 54 gm.

French Heavy Breeds. — Lot No. 46 (Faverolles), laid 557 eggs weighing an average 52 gm. The best hen of this class (a Gatinais bird), laid 1 eggs weighing on an average 58 gm.

Foreign Light Breeds. — Lot No. 79 (Ancona) laid 766 eggs weighing an average 59 gm. The best layer in the whole competition belonged to this lot. It laid a total of 187 eggs (weighing on an average 59 gm), more than 11 kg. of eggs.

Foreign Heavy Breeds. — The Buff Orpingtons laid 508 eggs. Average weight 61 gm. The hen placed first in this class belonged to this lot and laid 152 eggs each weighing 63 gm.

In comparing the results obtained for the different breeds as regards French light breeds it was found that out of the 29 lots competing, only 2 gained more than 700 marks, 6 got over 600, 3 over 500 and 14 over 400. Out of 11 lots of French heavy breeds only one gained over 500 marks and 2 obtained more than 400.

Out of 16 lots of foreign light breeds 1 obtained over 800 marks; 2 over 700; 4 over 600; 5 over 500; and 4 over 400.

Finally, out of 4 lots of foreign heavy breeds, 1 lot gained over 600 marks and 1 over 500.

Thus the light breeds did better than the heavy.

5 - *Note on the South African Bee.* — SKAIFE, S. II., (Inspector of Technical Education) in *Journal of the Department of Agriculture (Journal of South Africa)*, Vol. II, No. 4, pp. 353-357, figs. 5. Pretoria, April, 1921.

BEE-KEEPING

The breeds of bees reared in Europe and America are rarely found in South Africa. Italian bees, which were at one time imported, do not seem to thrive.

The bees usually found in the hives have yellow bands, and belong to *Apis adansonii* breed that is native to South Africa. *Apis unicolor* is rarely met with in the Eastern districts; this bee is rarer, and less quiet than *Apis adansonii*, but an excellent worker.

Natural crosses between the two breeds appear to be of frequent occurrence, and in the same apiary workers of both types and intermediate types produced by the same queen are often seen.

The pure *Apis adansonii* breed is well adapted to the conditions of South Africa; its characters vary considerably according to the different parts of the country.

As regards diseases, the European foulbrood, sacbrood (1) and parasitic have all been observed; American foulbrood has not yet been recorded. In order to prevent its introduction a law has been passed prohibiting the importation of bees, honey and wax (2).

(1) See R. April 1913, No. 398. (Ed.)

(2) See R. Jan. 1912, No. 3. (Ed.)

196 — **Value of Formaline Vapour as a Disinfectant in Apiculture, Especially in Combating Foul Brood** (1). — BORCHERT, A., in *Berliner Tierärztliche Wochenschrift*, Year XXXIII, No. 46, pp. 547-549, bibliography of 5 works. Berlin, November, 192.

The experiments made by the author for the purpose of determining the efficacy of formaline in the control of foul-brood have shown that the action of formaline vapour saturated with water vapour cannot be considered as satisfactory.

Honey-combs infected with the spores of bacteria and with micro-organisms in the vegetative state (*Bacillus alvei* Watson-Cheyne and Cheshire, *Bac. alvei* Krompecker, *Bac. megaterium*, *Bac. pyocyaneus* and *Bac. prodigiosus*), as well as cultures of bacteria in test-tubes were treated, but it was found that the formaline vapour only penetrates into small spaces with a narrow opening in such minute quantities that it was impossible to be sure of its destructive action.

Thus honey-combs infected with foul-brood cannot be rendered safe by the use of formaline, and treatment with formaline vapour cannot be substituted for MASSEN's method (2) which consists in destroying the pathogenic germs by melting the contaminated combs in a steam cerificator.

197 — **Fresh Water Pisciculture in North Africa.** — RIVIÈRE, C. H., in *Revue Agricole de l'Afrique du Nord*, Year XIX, No. 125, pp. 931-934. Algiers, December, 1921.

The species of fish found in the fresh or brackish waters of North Africa are few in number, and with 2 or 3 exceptions, of little importance from the point of view of food. Among the latter are the following:

1) A trout, *Salar macrostigma*, rare and only found in the mountainous region of Kabylia, Collo, Bougie and Babors, where the water is cold and clear owing to the altitude and the sheltering. This fish lives on rocky bottoms and dislikes mud, and at present has little value as an article of food.

2) The Eel, this fish, which is found frequently enough to be some times sold on the markets, is of good quality when taken from clear water, especially if it has abundant food. The author reared eels in the Experiment Garden at Algiers putting some of them into muddy water with little food, and others into clear water with a regular supply of food; he obtained heavier fish with better flesh by the latter method.

3) The Carp. This fish appears to have been imported to Constantine in 1857, when 40 young carp were sent with other fish by the Acclimatization Society and put into the pond at Djebel-Ouach, where they multiplied. A certain number of Tench were introduced at the same time. Ten years later all the fish in the pond were caught: there were 307 carp from 18

(1) Aus dem Laboratorium für die Erforschung und Bekämpfung der Bienenkrankheiten an der Biologischen Reichsanstalt für Land und Forstwirtschaft in Berlin-Dahlem.

(2) MASSEN, Über die unter dem Namen "Faulbrut" bekannten seuchenhaften Bienenkrankungen der Honigbiene, in *Mitteilungen aus des Kaiserlichen Biologischen Anstalt für Land- und Forstwirtschaft*, Heft 7, 2te Auflage, 1909.

By the same author, Weitere Mitteilungen ueber Bienenkrankheiten und ihre Bekämpfung. *Ibidem*, Heft 17, 1919. (Author's note).

o 45 centimetres long and 4 tench of 34 cm., as well as numerous fry of both species.

4) The Barbel, very common, two varieties being found: *Barbus atlensis* and *B. setifensis*. These fish are as a rule very thin, and more or less flavourless. They are very plentiful in the rivers of Morocco.

From the point of view of food value, none of the other species are of any importance, no matter what their surroundings may be. The Chromis is a fish with the flavour of the Perch, but it never attains a large size, and as it lives in the depths of the Sahara, could never be brought to market.

The following are all too small and too rare to have any culinary value: *Gobius*, *Cristiceps*, *Cyprinodon*, *Gasterosteus brachycentrus*, and *Tellia poda*; the same remark applies also to the rather larger *Leuciscus callenisi*, an insipid fish only found in the East of Algeria.

Some species seem to have been introduced with a view to acclimatization in Algeria, this was probably the case with the *Carrassius* or Cyprin, which was found in certain rivers of West Algeria long before the French occupation.

Without any undue confidence in the future of pisciculture in North Africa which is poor in clear, deep waters of good quality, it might perhaps be worth while to make some experiments in breeding, were it only for the purpose of increasing even to a small extent the food supply of certain regions, especially of those at some distance from the sea. East Morocco, with its abundant supply of pure water, could provide by means of its reservoirs of irrigation water and its barrages, excellent fish-ponds situated at different altitudes, while some of the rivers and streams would become stocked by the fry that must necessarily escape from confinement.

Carp and tench could be reared in the quieter waters of the lower reaches of the rivers or in lakes and ponds, as long as care was taken to avoid those whose waters contain large quantities of sea-salt, or calcareous salts. Transport would not be an unsurmountable obstacle in the way of stocking the waters with these two Cyprinidae, for they are strong fish and travel well.

Suitable surroundings for trout are not so easy to find, and the species is more difficult to propagate, as fertilised eggs must be obtained for transport. Thus although the Kabyle trout would almost certainly become acclimatized in Morocco, to obtain and transport fertilised eggs would present serious difficulties.

In default of this species, it would seem advisable to introduce the fry of the Californian trout (*Salmo irideus*), as these have already been tried with success.

98 - Coccids of *Cottus Gobio* and of Carp Fry. — I. GAUTHIER, M., in *Comptes rendus de l'Académie des Sciences*, Vol. 175, No. 16, pp. 671-674, figs. 6. Paris, October 10, 1921. — II. LÉGER, L. and STANKOVITCH, *Ibidem*, No. 17, pp. 742-744. October 24, 1921.

I. The author's investigations were undertaken with the object of determining whether a connection exists between the Coccids of sea and fresh-water fish of the same family. He examined the "Miller's Thumb",

Cottus gobio L., a species which, so far as he knew, had never been recorded as suffering from these parasites.

The experiments carried out at the Grenoble Piscicultural Laboratory revealed the presence, in specimens of *C. gobio* from the basin of the Isère of two species of tetrasporous coccidia (genus *Eimeria*), occurring either singly or together in the same host, but differing, from the type attacking the sea-form of *Cottus*. To the one species, which is characterised by its ovoid spores provided with a beak at one extremity, the author gave the name *Eimeria cotti*, the other which is a little larger and has ovoid biconical spores, alike at both poles, and often disposed in the form of a cross, he called *Eimeria piraudi*.

The author frequently found *Eimeria cotti* associated with *Eimeria piraudi* in the epithelium of the pyloric caecum and intestines of individuals of *C. gobi* coming from the Furon and the lower Isère. *Eimeria piraudi* had only been observed in the form of oocysts in the digestive tract of *Cottus* caught in the Isère in the neighbourhood of Grenoble. The oocysts are spherical, or slightly ovoid, and vary in size from 11 to 13 μ .

Of the two forms of *Cottus* coccids, only *Eimeria cotti*, a specialised type with a tubular process at one pole, is entirely different from the other coccids at present known to occur in fresh-water fish.

A study of the phylogeny of the 2 species shows that in all probability *E. cotti* is a primary parasite of *Cottus* whereas *E. piraudi*, an insignificant form of a type which is very common in fresh-water fish, would appear to be a secondary parasite connected with the adaptation of the genus *Cottus* to fresh-water conditions of life.

II. — In certain of the carp-breeding ponds of the South-East, the very young fry are often attacked by a coccid which completes its entire life-cycle within the epithelium of the intestine, where it multiplies to such an extent as to destroy the mucous membrane lining in some places, and cause a serious often fatal enteritis which greatly endangers the breeding prospects, for the fry that survive remain thin and weakly and their normal growth is arrested.

The authors describe the parasite, which is a new species, and suggest for it the name of *Eimeria carpellii* n. sp.

The fact that the same individuals harbour the parasite in all stages of development (the multiplication being both endogenous and exogenous), shows there is no intermediate host, the young fry becoming infected by the spores ejected into the water by diseased individuals. Hence the malady could be prevented by hatching and rearing the carp in ponds that have previously been drained dry.

The breeding-fish should be placed as late as possible in the pond, that is to say not before the temperature is suitable for egg laying and care must be taken to remove them as soon as possible after oviposition.

DUNISCH's method, which consists in frequently moving the fry from one pond to another (each pond having been previously kept dry until needed), has the additional advantage of providing the fish with surroundings entirely free from the germs of infection, and thus protecting them from the

intestinal forms of coccidiosis which, even when not fatal, hinder the growth of their hosts. In this manner, other factors being equal, the maximum quantitative and qualitative yield would be obtained.

FARM ENGINEERING.

199 - **Harvesting Sugar Cane by Machinery Advantages of the "Luce Sugar Cane Harvester"**. — *The Louisiana Planter and Sugar Manufacturer*, Vol. LXVII, No. 25, pp. 396-398, pl. 4, diagr. 1. New Orleans, Dec. 17, 1921.

AGRICULTURAL
MACHINERY
AND
IMPLEMENTS

Experiments with the LUCE sugar cane harvester were first started in 1900-1901 and have continued steadily for the last 20 years with a view to perfecting the present standard machine. The present model is now considered a practical, commercial machine, which will do the required work in such a way that the benefits derived from its use, all things considered, are sufficient, when represented in money values, to pay the interest charges or purchase price, the cost of working and the amortisation charges and still leave enough over to represent a fair net return on the initial investment.

Certain varying conditions encountered in different localities would affect the actual saving in cost per ton of cane harvested, e. g. the length of rows which has a direct bearing on the daily capacity of the harvester. The effect is shown graphically on the accompanying chart of curves. These curves also indicate the fact that the weight of cane per unit of area has also a direct bearing on the capacity and cost. For cane amounting to 20 tons per acre and in 1000 ft. rows, the capacity of the machine is approximately 16 $\frac{1}{4}$ tons per hour at cost of about 26 cents per ton. For this reason it is difficult to state exactly the cost per ton of cutting cane with this harvester, though it is evident that the cost is decidedly lower than with hand labour.

Another distinctly advantageous point lies in the fact that this machine gives a uniformly lower bottom cutting superior to that made by hand cutting, as the hand cutters invariably leave small stumps of cane in the fields. The bottom cutters of the LUCE harvester operate underneath the trash mat and cut the stalks off clean and square just at or below ground level. Besides leaving the stubble in excellent condition for the next crop, the yield is increased appreciably by the addition of from 2 to 4 in. of length to every stalk in the field. Careful experiments to determine the amount of the actual increase showed that the tonnage is increased by over 5 %. As this increase lies in the lower portion of the stalk, where the sucrose content per unit of weight is highest, the result is an increase in actual sugar yield per acre up about 8 %. It is estimated that the total amount of cane from a plantation, being say 25 000 tons from hand cutting, with a yield of 10 % would give 2 500 tons of sugar. With harvesters the increase in sugar yield (8 %) would be 200 tons. With sugar at 2 $\frac{1}{2}$ cents per lb. the actual money value of this increase of \$10 000.

Each stalk is handled individually and carried through the machine by steel conveyor chains, is topped at the last ripe joint, regardless of the

length of the stalk, and thoroughly stripped of leaves and trash before delivery at the rear. Delivery can be made direct into a trailer which dumps the cane in regular piles on the ground or is transferred to mill or cane hoist without entailing any hand labour . . .

The preparation of fields for the use of harvesters is neither expensive nor difficult, but necessary requisites are straight, long rows free from stumps and stones, while spacing should be sufficiently wide to avoid stooling entanglement with the machine, etc. Trash on the ground presents no difficulty, and may be as thick as 10-12 in. Leaning or blown cane is handled by these harvesters as effectively as clean, erect cane. The separator plough divides the row which is being worked from the one adjacent "and the pick-up fingers" lift the stalks to a substantially vertical position before the cutters reach the base.

200 - **Apple Packing Houses in the North Western Districts of the United States.** -

PAILTHORP, P. R. (Investigator in Marketing of Fruits and Vegetables) and SAMSON, H. W., (Specialist in Standardisation), in *Farmer's Bulletin* No. 1204, United States Department of Agriculture, pp. 3-39, figs. 26. Washington, D. C., June, 1921.

Description of the community packing houses, operated either by co-operative associations or by individuals in the apple-growing districts of the Northwest. The percentage of the crop packed in community houses is increasing steadily and estimates show that the amount increased from about $\frac{1}{4}$ of the total crop in 1916 to approximately $\frac{1}{2}$ of the crop in 1919. The same basic principles of construction and equipment are applicable to all types of houses and the equipment and methods of operation in the larger community houses are suitable to a large extent for use in the ranch houses.

This bulletin deals with the details of construction, arrangement, equipment and operations from the time of receiving the fruit for packing to their storage or putting on rail, and is based on a study of the methods and practices which have given the greatest satisfaction commercially. The figures illustrate the various points in construction including also grading belts, packing tables and stands, and suggested arrangements for gravity conveyors, elevators, chests, etc. An interesting packing floor plan shows the method employed in a well arranged community packing-house.

Fig. I here appended, shows the popular type of machine used for sizing boxed apples, and Fig. II, two types of lidding presses recommended.

The machines shewn in Fig. I, are 6 ft. 2 in. wide and vary from 30 to 52 ft. in length, depending upon the capacity. The smallest model is equipped with 8 bins and the largest with 48. They are provided either with a canvas sorting belt or with a roller sorting belt regulated by a lever operated by the head sorter. Opinions differ as to the relative merits of the two types of sorting belts. The sizing unit separates the fruit into 3 grades, each of which is delivered into a separate set of bins. The endless carrier

shown in the Fig. is composed of a series of cross rods carried forward by side chains, and from these are swung canvas-bottomed carrying cups. The cups are held in a horizontal position by the supporting prongs which

Apple Sorting Machine.

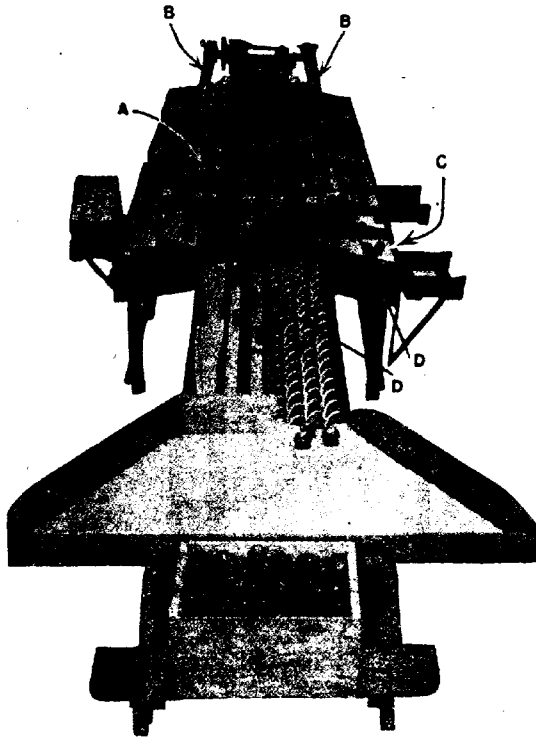


FIG. 1. — EXPLANATION :

- A = Sizing apparatus.
- B = Sorting belt.
- C = The Shaker.
- D = Detachable plates for the belt.

slide along the iron side rails. Over each bin there is an opening in the side rails which is bridged by the inner bars of simple balancing scales. At the opposite end of the scale are canvas pockets into which the standard size

apples are placed. All that is necessary in order to make the machine ready to work is to place an apple of the desired size in the pocket of the scale, as the fruit delivered to the bin will correspond in size to the regulating apples. The cups of the carrier receive the apples, and as they move forward the supporting prongs at the sides of these cups pass in turn over the inner ba

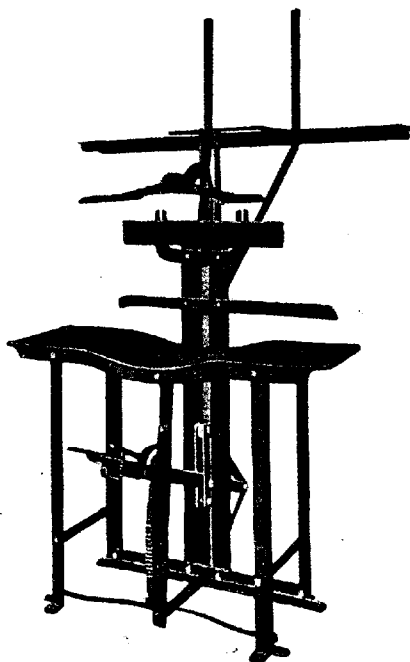


FIG. 2 — Press for fixing the covers.

of each scale until one is reached which is counterbalanced by a regulating apple that is slightly lighter than the apple in the carrying cup. The inner bar of the scale is then depressed slightly, allowing the supporting prong to pass through the opening in the side rail and causing the rear end of the carrying cup to lower gradually, thus delivering the fruit to the loop of webbing which are provided to break the fall of the fruit into the bin below.

With respect to Figs. II and III, the author states that a properly packed box should have a bulge of $1\frac{1}{2}$ in. in the centre but tapering so that the apples in the ends are flush with the top. After lidding the bulge is distributed equally between the top and bottom.

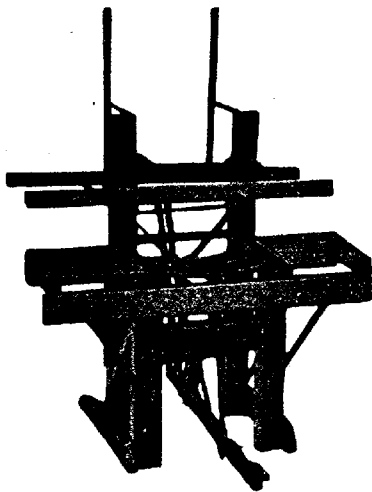


FIG. 3 — Press for fixing the covers.

[200]

201 - **Flue-Curing Tobacco Barns and Packing House.** — JENNINGS, A. C. (Government Irrigation Engineer), in *The Rhodesia Agricultural Journal*, Vol. XVIII, No. 5, pp. 529-533, Plans 3. Salisbury, October, 1921.

In consequence of the increased acreage under Virginian Tobacco and the possible need for more flue-curing barns, details of the most approved type of barns and packing house are here given, the plans and specifications given previously in the *Rhodesia Departmental Bulletin*, No. 334 dated Oct. 1919 being now cancelled. The accompanying drawings have been prepared under the advice of H. W. TAYLOR, Government Tobacco Expert.

The details given include specifications as to site, arrangement of buildings, foundations, walls, openings, roofs, furnaces and flues, ventilators and tiers.

As regards the packing house, the details specified for the barns may be applied, except where otherwise stated. A description is also added of the conditioning cellar built below ground-level under the packing house.

The plans illustrate 1) a block of flue-curing barns; 2) half elevation of back of barn; 3) half sectional elevation on centre line; 4) section through furnace, packing house, section elevations and plan.

A list is given of the materials required for a block of 4 drying barns (quantity, lengths or size, etc.), and also for the packing house.

[200-201]

AGRICULTURAL INDUSTRIES.

202 - **The Practical Organisation of Milk Control in Belgium.** — *Bulletin de la Commission permanente du lait*, August-September 1921, pp. 70. Brussels.

The Permanent Milk Commission gives in this Bulletin a summary of the discussions that took place between the members of the Commission appointed to consider the question of the practical control of milk. At the meeting on July 7 1921, the following resolutions were unanimously passed by the members present.

"The Permanent Milk Commission after a thorough and careful study of the practical measures to be adopted for the organisation of milk control in order to insure the purity and hygienic condition of milk which plays so important a part in the preservation of public health, has come to the following conclusions:

1) It is most desirable that Public Administrations and Agricultural Societies should increase and encourage cow-shed competitions. It would be well to resume the keeping of herdbooks.

2) All milk control should be founded upon the veterinary inspection of cowsheds and milch cows, in accordance with the royal decree based on the findings of the Permanent Milk Commission.

The Permanent Milk Commission is further of opinion:

a) that with the assistance and under the supervision of the Public Authorities, a group of milk producers should be formed of which the members should voluntarily subject their cows and cow-sheds to inspection. The milk of these cows should be tested from the hygienic, chemical and bacteriological standpoints. The producer of pure, wholesome milk should receive remuneration for this control, and this remuneration should be adequate and of a public character.

b) that the Governing bodies, both official and private, of hospitals, crèches and day-nurseries, etc., should forbid the use in their institutions of all untested milk, or of any milk coming from dairy-farms where the premises are not subjected at least to veterinary inspection.

c) that the above-mentioned institutions should be provided with the plant necessary for keeping milk fresh and in good condition."

203 - **A Method for Detecting the Admixture of Goats' Milk to the Milk of Cows.** — AUSTEN, W., in *Deutsche Schlacht- und Viehhof Zeitung*, Year XXI, No. 25, p. 211. Berlin, 1921.

This method is based upon the fact that the casein of cow's milk is completely dissolved by ammonia, whereas the casein of goat's milk is insoluble in ammonia (1).

(1) See *R. March* 1916, No. 342. Another method has been described by A. GABOTHILLER (*Zeitschrift für Untersuchung des Nahrungs- und Genussmittel*, Vol. 32, Part. 10, p. 455. Berlin, 1916). Goats' milk coagulates when subjected to the alcohol test, even if the degree of acidity is below 8. Milk with ordinary sediment and with a degree of acidity below 8, may be suspected of containing goat's milk if a precipitate is formed on the application of the alcohol test. The admixture of 30 % is easily detected. By a double alcohol test, the

This method does not give any practical values unless the milk is normal, that is to say, fresh. In order to keep milk fresh, bichromate of potassium is used instead of formaldehyde, which modifies the casein to the point of rendering it insoluble in ammonia, even after boiling.

The milk for the test should be as fresh as possible and free from all fat. The skimming is effected in the GERBER tubes generally used for determining the fat content, but they are closed at both ends with indiarubber stoppers. The fat that accumulated during centrifugation (temperature of milk 50° C) in the narrow portion of the GERBER tube is extracted by means of a glass tube attached to the sides. The 20 cc. of milk thus treated are heated in a water-bath at 50-60° C, then 2 cc. of 25 % ammonia are added and the mixture is kept at this temperature for half-an-hour, care being taken to shake it from time to time. The tubes are next placed in the centrifugator with the graduated part turned towards the periphery, and centrifugated for some minutes at the rate of 1200 revolutions per minute.

This method gives dependable results in the case of cow's milk which has been adulterated with goat's milk, provided 20 % of the latter is present: below 20 % the results are uncertain. As the qualitative test had given very good results, the author tried to apply it in determining the amount of goat's milk in the mixture. Cow's milk, with the addition of respectively 20 - 30 - 40 - 50 - 60 % of goat's milk, was skimmed, 2 cc.

addition of 10 % can be determined. With the alizarol test, woman's milk becomes violet, goat's milk brownish-yellow and cow's milk a lilac-red. In the reaction to neutral red suggested by MORO, woman's milk turns yellowish red, goat's milk orange, and cow's milk red. By their reaction in the presence of Nile-blue sulphate, woman's milk (white) can be distinguished from cow's milk (blue) and goat's milk pale blue. With the ammonia test proposed by U. UMKOFF, woman's milk assumes a colour varying from pink to violet; the casein of goat's milk swells, whereas that of woman's milk and of cow's milk dissolves. In U. TUGENDRICH's nitrate of silver reaction, woman's milk becomes a coffee-brown without coagulating; goat's and cow's milk coagulate and the coagulum turns brown later. STEIN-EGGERS' ammonia method combined with a centrifugal process makes it possible to detect even 3 parts of goats' milk in 100 parts of cow's milk.

There is on this subject another study by PRITZLER (*Ibidem*, p. 453-454). The method proposed by STEINEGGER (*Landwirtschaftliches Jahrbuch der Schweiz*, 1903, p. 233 and 1904, p. 221) has been modified by PRITZLER in so far that instead of reaction tubes, SCHMID's albuminometer is used. About 22 cc. of milk are centrifugated for 5 to 10 minutes at a velocity of 1400 revolutions per minute; the layer of fat is separated; 2 cc. of concentrated ammonia are added to the skimmed milk in the test tubes and the latter are shaken; they are then kept for half-an-hour in a water-bath at 45° C, and centrifugated for 3 minutes at 1400 revolutions per minute after which: in the case of pure goat's milk, there is a deposit of 8-12 cc.; in mixtures of equal parts of goat's and of sheep's milk, there is a deposit of 4-5 cc.; in a mixture containing 30 % of goat's milk, the deposit is about 3 cc.; when there is 20-15 %, the deposit is 2.1 cc. and with an admixture of 10-5 %, from 1 to 0.4 cc. Sometimes, no deposit is formed when the milk is 24 hours old, but coagulation takes place in the addition of 1/1000 of formaldehyde. Goat's milk, when treated with formaldehyde, behaves in the same manner whether 60 hours old or quite fresh. Cow's milk gives no precipitate after 60 hours on being treated with formaldehyde. (Ed.)

of 25 % ammonia added, and the mixture after heating in the water-bath was centrifugated for 10 minutes at a very high speed.

The precipitates in the GERBER tube were very well defined, and on being repeatedly measured, gave figures in the following table.

Volume (in cc.) of the precipitate obtained in different milks.

Proportion of goat's milk in the mixtures					Pure goat's milk
20 %	30 %	40 %	50 %	60 %	
0.6 cc.	1.2 cc.	1.6 cc.	2.0 cc.	—	5.6 cc.
0.6	1.1	1.6	2.1	3.1 cc.	5.5
—	1.0	1.4	2.0	—	5.5
0.5	0.9	1.5	2.2	—	—
—	1.0	1.6	2.3	3.2	6.2
0.4	—	2.0	—	3.1	—
—	1.4	—	—	3.2	—
0.5	—	—	2.2	—	—
—	0.9	1.7	2.3	3.3	—
<i>Averages</i> . 0.5	1.1	1.6	2.1	3.1	5.7

Admixtures of 70 — 80 — 90 % of goat's milk gave very variable results. In mixtures containing from 20 to 50 % of goats' milk, every additional 10 % of goat's milk could be determined from an increase of about 0.6 cc. in the precipitate.

201 — **A Theoretical and Practical Study of the Ensilage of Forage Plants and of the Adaptation of the Process to the Requirement of Argentina.** — SCASSO, J. M., Ministerio de Agricultura, División de Investigaciones agrícolas y Estudios especiales *Ensilage*, p. 420, figs. 53. Buenos-Aires 1920.

This work, which is principally intended for practical stock-breeders, gives an exhaustive description of the different ways of ensilaging forages and the qualities of the silage obtained, particularly from the point of view of the special conditions of stock-breeding in Argentina. This is the criterion according to which the advantages and disadvantages of each type of silo in the different districts are discussed, the choice in each individual case being based upon local requirements.

The theoretical principles of ensilage are also stated, in order to serve as a guide for the handling of the forage treated. The practice of feeding stock on ensilage is taken into consideration and different rations and many subjects suitable for experiment are suggested. The economic factor receives due attention in a special chapter, and finally the author describes the plants most suited for ensilage, and studies their several possibilities, advantages and disadvantages.

The author especially recommends the use of ensilaged fodder in the feeding of young steers; he rates its value below that of fresh grass and above that of hay. Under the existing conditions in Argentina, more than 45

to 50% of the dry matter of grass is lost in hay-making, whereas under the most unfavourable circumstances not more than 25 % is lost during ensilage. Further, one ton of hay in the rick costs 6 to 7 *pesos*, but one ton of silage only costs from 2.7 to 3.7 *pesos*.

The plants most suited for ensilage in Argentina are lucerne, maize and sorghum. It would be worth trying in addition clovers, Hungarian "Moka", the "teosinte" (*Euchlaena luxurians*) and the sunflower. In districts where it flourishes, lucerne is always the best plant for ensilage (the native variety which is not infected with *Cuscuta* should be chosen); on clay soils, sulla can very well be planted instead of lucerne. Maize should only be given the preference where it is cultivated intensively, and already acclimatised varieties must be chosen such as "amarillo canario", "colorado de Baradero", "piamontés", etc. Recourse may be had to sorghum in the dry northern and western zones, where the best varieties appear to be the Sudanese, "Kafir Standard", and sugar sorghum. Wheat, barley and oats should only be ensilaged when locusts threaten the grain production. Lucerne suits all types of silage, while maize is most adapted to cylindrical forms built above ground.

If lucerne and maize are ensilaged together, the most satisfactory proportions are 2 parts of lucerne to 1 of maize, if it has not headed, or 1 of lucerne to one of maize, if bearing half-ripe cobs. Should the farmer have any molasses at his disposal, excellent results are obtained by ensilaging 15 parts of lucerne and 1 of molasses.

A perfect product results from the ensilage of unchopped lucerne. Maize can be put whole into the silo, though chopped maize gives better results, but it is expensive and works out to about 2 *pesos* per ton (1 paper *peso* = 2.20 fr. at par). Should a forage-chopper be bought for the purpose, one should be chosen with a large return and spiral rather than with flat blades. A forage-chopper cutting up one ton an hour requires a 13 HP engine.

Salt is not necessary, but if used, 1 kg. to 1.5 kg. is added per cubic metre.

The author reckons that after deducting the cultivation expenses for the lucerne and maize, plus the cost of cutting and transport to the silo, one ton of lucerne by the time it reaches the silo costs 1.40 *pesos* in Argentina; the cost of maize per ton being 2.59 *pesos* if cut by machine; 2.72 *pesos* if cut by hand and 1.74 *pesos* if cut by the maize reaper-and-binder. One ton of available forage (that is to say after deducting the losses sustained during ensilage), costs according to the silo used:

1) *Pit silo*: lucerne: 3.68 *pesos*, if ensilaged unchopped; 5.46 *pesos*, if chopped; whole maize, 5.46-5.63 — 4.31 *pesos*, according to whether it is cut with a reaper, a hay-sickle or a binder-reaper; as for chopped maize, the first quality costs 6.86 *pesos* and the inferior quality, 5.85 *pesos*.

2) *Stack-silo covered with soil, or kept in position by weights*: cost of lucerne 2.69 *pesos*; of maize 4.34 *pesos* or 3.22 *pesos*, according to whether it is cut by a reaper, or a binder-reaper (for this type of silo, only unchopped maize is used);

3) a good-sized, wooden cylindrical silo constructed above ground; unchopped lucerne 7.01 pesos; chopped lucerne 8.77 pesos; chopped maize cut with a reaper 10.08 pesos, chopped maize cut with a binder-reaper 9.15 pesos (maize used in cylindrical silos above ground must always be chopped);

4) Reinforced-concrete silo: chopped or unchopped lucerne 6.53 or 4.77 pesos respectively; chopped maize 7.84, or 6.91 pesos, according to whether it was cut with a reaper, or with a binder-reaper;

5) Reinforced-masonry silo: chopped or unchopped lucerne 6.31 or 4.55 pesos; chopped maize 7.62, or 5.69 pesos, according to whether it was cut with a reaper, or a binder-reaper.

The most economical kind is unchopped lucerne silage made in a silo stack. This type should always be made where extensive cultivation is practised.

Stock ought not to be exclusively fed on ensilaged forage as to give them nothing else is neither economical nor wholesome. In case of necessity, however, animals while being fattened may be given this food alone if no hay or concentrates can be obtained. No better food exists for milch cows that are permanently housed than 15 to 20 kg. of ensilaged forage per head and per day, with the addition of concentrates. If these consist of linseed cake mixed with grain, not more than 0.5 kg. per head and per day should be fed.

There is no proof that a diet of ensilaged forage causes abortion in females in an advanced stage of pregnancy. To prevent the milk acquiring the smell of the forage, all that is necessary is to remove the milk-pails from the shed as soon as the cows are milked.

The second part of the work contains the answers given by the different agriculturists to a form of questions distributed by the Division of Agricultural Research and of Special Studies of the Ministry of Agriculture of Argentina. It appears from the replies given that ensilage met with general approval wherever it was used.

205 - Storage of Potatoes. Comparative Effects of Light and Darkness. — MATIAS, J. in *Journal d'Agriculture Pratique*, Year 85. Vol. II, No. 50, pp. 498-499. Paris Dec. 17, 1921.

As a result of the statement made by NOFFE to the effect that it is more advantageous to store potatoes in darkness than exposed to the light, conditions otherwise being equal, PAROW made comparative experiments with the object of elucidating this question. The details of his work are given in NAGEL's report in the *Zeitschrift für Spiritus-Industrie*, Berlin. The following résumé is here made by the author.

Two lots of potatoes, of absolutely identical character, weighing 5 kg each, were placed in a cool (9° C) dry open spot on January 17, 1921 and allowed to remain there until July 22. One of these lots was placed in an open case and consequently was exposed to light, the other was placed in a closed case, i. e. in darkness.

The potatoes were weighed and analysed at the beginning and end of the experiment and from the reports made, the following results are distinctly worthy of note.

After 6 months storage	Open case	Closed case
	— %	— %
Loss on gross weight of tubers	17.20	14.00
Loss of starch content of potatoes	21.86	15.25
Loss of sugar content of potatoes	80.00	60.00

It is already recognised that the loss in dry matter from tubers stored in a cellar or silo from the beginning of the germination period (end of the winter) is greater than the loss resulting solely from respiration. On the contrary, light retards germination and may assist in restricting the loss of starch content which accompanies the process and results from the formation of diastases; darkness is on the other hand, useful previous to germination, that is to say, it acts only as a contradictory element as regards the losses provoked by respiratory phenomena.

Contradictory results have hitherto been obtained through not making a sufficiently clear distinction between diastatic and respiratory phenomena.

206 - **Transport of Market Produce by Aeroplane.** — JACMAIN, E., in *Revue horticole belge*, Year 2, No. 12, pp. 169-170. Ifuv, Dec. 1, 1921.

The author states that where it is possible to utilise an aeroplane service for the carriage of produce as at London, Paris, Brussels, Amsterdam, this form of transport is superior to the railway for high priced flowers such as orchids, lilies, roses, etc. Although the cost of air transport is comparatively high, it is certain that the flowers will reach their destination fresh and undamaged and that consequently they, will fetch a higher price.

At the present time an air service for goods has been established between Brussels, Rotterdam, Amsterdam, Paris and London: the journey from Brussels to Rotterdam takes 1 hour 10 minutes; from Rotterdam to Amsterdam, 30 minutes; from Brussels to London, 3 hours 30 minutes.

PLANT DISEASES

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

207 - **Forms of Hop Resistant to Mildew (*Sphaerotheca Stumuli*)** (1). — SALMON, E. S., in *The Annals of Applied Biology*, Vol. VIII, Nos. 3-4, pp. 146-163. Cambridge Nov. 1921.

The wild hop (*Humulus Lupulus* L.) is composed of a number of forms which show distinctive physiological and constitutional characters.

One of these characters is the grade of susceptibility to the attack of the hop mildew (*Sphaerotheca Humuli*); these characters vary from extreme susceptibility shown both in the open and under greenhouse conditions, to a high degree of resistance in the open, and complete immunity in the greenhouse, with intermediate grades. Out of 291 ♀ seedlings examined, 165, or 56.70 % showed extreme susceptibility, while 18, or 6.19 % were "commercially resistant". The remainder fall into intermediate groups. Out of 480 seedlings, ♂ and ♀, 27, or 5.63 % were completely immune, and 7, or 1.46 % semi-immune under greenhouse conditions.

As a general rule, seedlings immune under greenhouse conditions conserve their high degree of resistance in the open.

208 - **Red Currant Varieties comparatively Resistant to American Gooseberry Mildew (*Sphaerotheca mors-uvae*) in England.** — SALMON, E. S., and WORMALD, H., in *The Gardener's Chronicle* (Third Series), Vol. LXX, No. 1804, p. 17, figs. 1. London, July 23, 1921.

In the fruit plantations at Wye College (Kent), in 1921, an unusually virulent outbreak of American Gooseberry Mildew (*Sphaerotheca mors-uvae*) on the gooseberry bushes (*Ribes Grossularia*) was followed by the appearance of this mildew on certain varieties of red currants (*R. rubrum*). In a border where Allington Pippin apples are interplanted with red currants, the young shoots of some of the currant bushes were seen on June 26 to be affected with mildew (*Sph. mors. uvae*). The effect was easily noticeable as the mildewed leaves curled somewhat so as to show the under surface on which large white, powdery patches of mildew were prominent. Further examination showed the presence of the brown, scurf-like patches of the perithecial stage of the mildew on the young stem and the young green berry.

(1) See also R. Febr. 1918, No. 232. (Ed.)

Investigation showed that only certain of the red currant bushes in this border were attacked. About 90 % of the border consisted of "Fay's Prolific", but the bushes attacked were clearly not of this variety, but of various types, and some were probably "Raby Castle". The affected bushes were interplanted with "Fay's Prolific" which remained healthy.

Another part of the same plantations gave equally convincing evidence of the resistance of "Fay's Prolific" to this mildew. A group of "Raby Castle" bushes were growing near a group of "Fay's Prolific". Here again all the "Fay's Prolific" bushes were quite free from attack, while the "Raby Castle" bushes immediately adjoining were badly affected.

The economic importance of the occurrence of the American Gooseberry Mildew in the red currant lies in the fact that the winter stage (carrying the winter spores or ascospores) occurs on the leaves, and is not confined as is usually the case with the gooseberry, to the stem. Where red currants adjoin (a gooseberry plantation, there is a danger of early outbreaks of this mildew on the latter, due to the presence in the soil of spores conveyed by red currant leaves. Affected shoots of red currant should be cut off and burnt before the leaves fall.

99 - The Efficacy of Fungicidal Dusts for the Control of Wheat Smut (*Tilletia Tritici*) (1). — MORETTINI, A., in *Le Stazioni sperimentali agrarie italiane*, Vol. LIX, Parts 7-10, pp. 293-315. Modena, 1921.

MEANS
OF
CONTROL

Prophylactic experiments against wheat smut (*Tilletia Tritici*) have been carried out since 1920 at the Casalina Agriculturists' Section of the "R. Istituto superiore agrario sperimentale" of Perugia. The object of these experiments was to test the efficacy of the time-honoured copper sulphate treatment as compared with the dry or powder method. In addition to the copper sulphate dust, "polvere Caffaro" was also used. The physical character and chemical composition of this powder seem likely to produce good results. By way of experiment the Caffaro powder was mixed with water in the proportions of 1 and $\frac{1}{2}$ %. Its reaction being slightly acid renders superfluous the second lime-milk bath in the case of wheat seed that has been already treated by the fungicide. In the control copper-sulphate treatment, a $\frac{1}{2}$ % solution of Cu SO_4 was used. The grain was immersed for 15 minutes, and then immediately neutralised with alkali of lime. After treatment the seeds were left to dry in the usual manner.

The powder treatment was carried out in glass balls with a capacity of 500 cc. in which the diseased wheat was placed together with the necessary amount of the fungicide and shaken for 3 or 4 minutes.

Both the copper carbonate dust and the "polvere Caffaro" were used in doses increasing from 2 to 15 $\frac{0}{100}$. With 2 $\frac{0}{100}$ of copper carbonate there remained, after shaking for 3 to 4 minutes only slight traces of the

(1) See also *R.*, April 1921, No. 419. (Ed.)

fungicide, but with larger amounts the residuum increased in proportion to the ‰, even after the seed had been repeatedly immersed. With "polvere Caffaro" the residuum exceeded 3 ‰. Although this powder is impalpable like the copper sulphate dust, it adheres much more closely to the seeds. Naturally the adherence of the two fungicides, when they are equally fine, depends upon the variety of wheat and its hygrometric condition. Some of the seed was treated 20 days before sowing, and it rested on the day it was put in the ground. A sample of each lot of seed was taken, in order to determine its germinating capacity immediately after treatment, and at the end of some months. The same measures were adopted in the case of the seed treated with copper sulphate and "polvere Caffaro" (after soaking in water), and the results of the two fungicides were compared.

The wheat used in every case was the hybrid Passerini which had been sorted by machine and contained some crushed and damaged seeds.

In the first series of experiments the wheat was thickly dusted with the spores of *Till. Tritici*, so that the whole mass was of a brownish color. Practically it would be difficult, if not impossible, to meet with seed infected to this extent, for the mechanical processes of winnowing and sowing partially clean the caryopsids. The experiment was, however, useful from the research standpoint.

In a second series of experiments the wheat was infected with few spores and the conditions more nearly resembled those that actually exist under ordinary conditions.

The principal points to be determined were: 1) the effect of the fungicides upon the germinating capacity and energy of the seed; 2) the effect upon wheat smut; 3) their influence on yield.

The following conclusions were drawn from these experiments:

1) The usual treatment with ½ % copper sulphate which consists in soaking the seeds in the solution for 15 minutes and removing the acidity of the copper sulphate by means of lime, has no perceptibly injurious effect upon germinating power or energy.

2) The application of powder, whether copper sulphate dust, or "polvere Caffaro") in the proportions of 2 to 6 ‰ had the same effect upon the germinating power of the wheat. Other factors being equal, the germination was improved.

3) In the case of wheat seeds that have been intentionally and excessively infected with the spores of *Till. tritici*, treatment for 15 minutes with a ½ % solution of copper sulphate is more efficacious in destroying the fungus, than the application of 2 — 4 — 6 ‰ of copper carbonate or "polvere Caffaro". The same applies to the strong doses, viz, those from 10 to 15 ‰.

4) On the other hand, where the wheat was less infected, though to a degree much exceeding any infection that could occur naturally, the dusting treatment is most efficacious; 3 ‰ carbonate of copper having a greater effect on the fungus than spraying with copper sulphate, while 4 ‰ "polvere Caffaro" is slightly less efficacious.

5) "Polvere Caffaro" used in the proportion of 4 ‰ is a little less active than copper carbonate, but does all that is required.

6) Dusting, whether with copper carbonate, or "polvere Caffaro" is equally efficacious, if done on the day of sowing; it has no injurious action even if carried out eight months previously.

7) "Polvere Caffaro" mixed with water in the proportion of ½ % and applied for 15 minutes behaves like a similar solution of copper sulphate and renders superfluous any neutralising treatment with lime.

As regards the practical carrying out of the dusting treatment, whether copper sulphate or "polvere Caffaro" are used, the success achieved on a small scale by mixing the infected seed and the fungicide in little glass balls would seem to show that good results might be obtained with some adaptation of ordinary movable churns or similar apparatus, or even of simpler and cheaper appliances. The churn should be three-quarters filled with wheat and the fungicide, so that a few turns of the machine are enough to mix them thoroughly. Such an apparatus can be worked by machinery like the sorters used in the mechanical sorting of seeds. In the case of small quantities of wheat, use can be made of little barrels containing less than 1 hectolitre and with an opening allowing the wheat to be quickly introduced and removed. The wheat and the fungicide can be thoroughly mixed by simply rolling the barrel.

The author is, however, of opinion that further experiments are required, both for determining the efficacy of fungicidal dusts in preventing the attacks of *T. tritici*, and for testing the best apparatus for carrying out the treatment.

110 - Stem-Rust Infection in Wheat in North-Dakota U. S. — See No. 159 of this Review.

111 - *Phyllosticta Montemartini* n. sp., a Deuteromycete Injurious to the, *Loganiaceae Buddleia variabilis*, in Italy. — CIEFFRI, R., in *Rivista di Patologia vegetale*, Year XI, Nos. 9 and 10, pp. 114-115. Pavia, December 29, 1921.

In the neighbourhood of Macerata, three young specimens of *Buddleia variabilis* — a Loganiaceae hitherto only grown in gardens as an ornamental shrub, but recently recommended for cultivation because of the signal service it renders to apiculture on account of its long flowering season and the wealth of its floral nectaries — were found at the beginning of the summer of 1921, to be suffering from fungus attack. Small, irregular patches of a yellowish-red colour and surrounded by a narrow whitish halo were observed on the leaves, and especially on their edges. Later, there appeared, on the infected part of the leaf-blade, the fructifications of a fungus regarded by the author as the pathogenetic agent described by him under the name of *Phyllosticta Montemartini* n. sp. The diseased patches subsequently withered and became detached, leaving the leaf riddled with holes. At the end of the summer the leaves died and fell so that the shrubs became prematurely defoliated.

Spraying with Bordeaux mixture should be tried as a preventive and curative measure.

DISEASES
OF VARIOUS
CROPS

212 - *Fusarium cubense*, a Hyphomycete Injurious to the Banana in Porto Rico. — See No. 277 of this Review.

213 - *Colletotrichum Kaki* n. sp., a Deuteromycete Injurious to *Diospyros Kaki* var. *Kiombo*, in Italy. — MAFFEI L., in *Rivista di Patologia vegetale*, Year XI Nos. 9 and 10, pp. 116-118. Pavia, December 29, 1921.

A specimen of *Diospyros Kaki* var. *Kiombo* growing in the Botanic Garden at Pavia has suffered since 1919 from a characteristic disease manifesting itself in the form of small patches nearly always occurring on the edges or at the tips of leaves, but occasionally found on the blade whence they spread towards the centre and cover a great part of the surface of the leaf. The portion attacked withers and breaks, and finally the whole leaf falls. The spots which are of a more or less deep shade of hazel brown, are dotted about the healthy portion of the leaf, and stand out from the vivid green of its surface giving it a contorted warty appearance.

As the patches increase in size, they present concentric striae. In the end the spreading spots become confluent, affecting a large part of the blade and sometimes even covering it entirely.

Upon these affected patches on the upper surface of the leaf, numerous small pustules make their appearance, which when fully grown, are visible to the naked eye and are the fructifications of the pathogenic fungus. The author speaks of the disease by the popular name of "macchie fogliari del kaki" (leaf-spots of the kaki), and describes the fungus as a species new to science, under the name of *Colletotrichum Kaki*.

214 - The Oak Oidium on the Chestnut Tree in Emilia, Italy (1). — MANARES, A. in *Le Stazioni sperimentali agrarie italiane*, Vol. LIV, Parts 7-10, pp. 289-292. Modena, 1921.

During the second half of July 1921, many young chestnut seedlings which had been sown the previous spring in the forest nursery of Bonbiana, in the Commune of Gaggio Montano (Prov. of Bologna), were found to have their leaves, and also sometimes their stems attacked by a fungus that was identified as being without any doubt *Oidium quercinum* Thüm., a very common parasite of the oak, and occurring in the neighbourhood of the nursery on the young oak buds.

The presence of oak oidium on the chestnut tree had been reported in France in 1908, and observed in other parts of Italy besides Emilia, viz. in the vicinity of Savona, Prov. of Genoa (1909), near lake Nemi, Prov. of Rome (1915), as well as in the neighbourhood of Vittorio Veneto, Prov. of Treviso (1915), but in no previous case had young individuals been attacked.

In 1911, the parasite was again discovered on strongly growing chestnut cuttings at Zocca, Prov. of Modena, towards the end of August, and at Fontanelice, Prov. of Bologna, at the end of September.

(1) See also R. Feb. 1920, No. 264; R. Sept. 1920, No. 922; R. May 1921, No. 508. (2)

According to the author, it is most probable that the parasite overwinters in the buds of the young host-plant, in which case it would be in a position when the spring came to infect the new shoots.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS

- 215 - **Artificial Production of "Tipburn" of Potatoes** (1). — FENTON, F. A., and RESSLER L. L., in *Science*, New Series, Vol. LV, No. 1411, p. 54. Utica, N. Y., Jan. 17, 1922.

GENERAL

Experiments conducted at the Iowa Experiment Station have shown that the Rhynchote *Empoasca mali* (Potato leaf-hopper) is the factor concerned with the production of "tipburn" or "hopperburn" of the potato. Emulsions were made by crushing a large number of adults of both sexes in water and small quantities injected into the leaves of potato plants; in a few days the injury was apparent, similar to, if not identical with "tipburn." Difficulty was experienced in introducing large amounts of the emulsion into the leaf tissue, but enough was injected to induce the change. When the emulsion was placed on the leaf and the tissue pricked with a fine needle negative results were obtained. Emulsions made from crushed nymphs failed to cause damage except in a few cases, and even then it was not pronounced.

That these insects contain some toxic substance was further demonstrated by placing the residue left over from the insects after the emulsion had been poured off on leaf petioles and then inoculated by means of a fine scalpel. In every case a lesion was produced, the tissue at these points first turning yellow and then brown. Later the cells collapsed, leaving a fairly large scar.

Although Bordeaux mixture is toxic to the nymphs, it acts comparatively slowly so that by keeping a leaf sprayed with this compound colonised by live nymphs, "tipburn" was produced. This would appear to show that Bordeaux mixture does not prevent "tipburn" by its action on the leaf but rather by its action on the insect.

- 216 - **Howardula benigna**, n. gen. and n. sp., a Nematode Parasite of *Diabrotica vittata*, *D. trivittata* and *D. 12-punctata*, in the United States. — COBB, N. A., in *Science*, New Series, Vol. LIV, No. 1409, pp. 667-670, figs. 4, Lancaster, Pa. December 30, 1921.

MEANS
OF
CONTROL

This article gives a description of the Nematode, *Howardula benigna* Cobb, n. gen. and n. sp. which is common in the body-cavity (abdomen, thorax and also the head) of the cucumber beetles *Diabrotica vittata*, *D. trivittata* and *D. 12-punctata*, especially the first. The nematode infests the two sexes of its host about equally.

The new parasite of *Diabrotica* spp. was first discovered at Marietta, Ohio, but subsequent study of its geographical distribution has shown that in 1921, it was probably co-extensive with the distribution of its main hosts *D. vittata* and *D. trivittata*.

(1) See R. July 1921, No. 2295. (Ed.)

About 1500 individuals of *D. vittata* were examined; they came from different states of the North-American Confederation (Ohio, Illinois, Maryland, Michigan, Massachusetts, Virginia, Iowa, Mississippi, Montana, Texas, Minnesota, Louisiana, North Carolina, Connecticut, Alabama) and also from Canada (Nova Scotia and Ontario).

The nematism is often high and affects on an average 20 % (0 % — 70 %) of the beetles. The insects which come from a locality where they are not attacked by the Nematode are larger and more vigorous. Anatomical evidence shows the infested female beetles to be less fertile than the non-infested. In none of the numerous lots of beetles examined was the rate of infestation by any other animal-parasite as high as by *Howardula*, with the single exception of a 43 % dipterous infestation, but no note was made of degrees of phyto-infestation. As many as thirteen thousand Nematode larvae have been removed from the body-cavity of a single *Diabrotica vittata* and no doubt the number may go yet higher. On several occasions 20 or more adult specimens of *H. benigna* have been taken from a single beetle. Theoretically these should produce some forty thousand larvae or more. The older female beetles, when attacked by the Nematode, deposit a few to upwards of fifty of the nematode larvae with each egg. The grubs soon mature on the eggs or in the soil (where they can live several weeks), moult, develop a more perfect spear, and by its aid begin to make their way into the body-cavity of the beetle-larvae soon after the latter hatch out. It is rather improbable that the Nematodes enter their host by way of the mouth and alimentary canal.

217 — *Oriolus luteolus*, A Bird Useful to Agriculture in India. — FLETCHER, T. B. and ENGLISH, C. M. in *The Agricultural Journal of India*, Vol. XVI, Part. 3, pp. 231-234, 1 coloured plate. Calcutta, 1921.

Oriolus luteolus (the Indian Black-Headed Oriole), has long been known in Indian ornithological literature under the name of *O. melanocephalus*.

In India it is strictly arboreal in its habits and rarely seen on the ground; it lives chiefly on fruit and the small insects on the leaves and stems.

C. W. MASON examined the stomachs of twenty-three of these birds at Pusa, and found that seventeen of them had fed on wild fig fruits; the stomachs of five contained nothing else. The stomachs of the 18 birds which had fed on insects contained ninety-five, of which four were classed as beneficial kinds, seventy-three as injurious, and eighteen as neutral. Five birds had eaten insects only. In the Central Provinces, F. A. D'ABREU found a Pyralid caterpillar and a *Ficus* fruit in the stomach of one Blackheaded Oriole on January 24, 1914. At Pusa, the authors watched the Oriole feeding on a mass of mealy-bug clustered on the stem of a wild vine growing on *Dalbergia Sissoo*. So far as agriculture is concerned, therefore, this bird may be considered as beneficial. *O. luteolus* has never

(1) See R. July 1911, No. 2295. (*h.d*)

been seen to attack cultivated fruits. This bird is protected throughout the year in Bombay, the United Provinces, Bihar and Orissa, Bengal, Assam, Burma, Madras and Mysore.

18 - **The Use of Crystalline Ferrocyanide of Potassium as an Insecticide** (1). — RAYBAUD, L., in *Comptes rendus hebdomadaires de la Société de Biologie*, Vol. LXXXV, No. 33, pp. 935-937. Paris, 1921.

The author has investigated the effect produced upon the scale-insect *Aspidiotus rusci*, a common parasite of the fig-tree in Provence, by potassium ferro-cyanide applied for two consecutive years according to the method adopted in California since 1914 by SANFORD (2).

In February the author selected fig-trees with a diameter at man's height from the ground, of 0.15 to 0.30 m., and made in their trunks a tubular cavity with a lumen of 0.01 to 0.03 m. and varying in depth from 0.06 m. to 0.15 m. In the case of some of the trees, the cavity was filled with the cyanide, in others it was left empty; the orifice however was always hermetically closed with a cork or wooden plug. A bluish liquid was seen to exude from the wound, when the cavity had been filled with ferro-cyanide, but not otherwise. Some of the branches of the trees containing the cyanide had been affected, and any leaves they already bore were destroyed a few days after the operation. The buds withered, and dried up completely, in the following year, while the branches themselves assumed the appearance of dead wood. Any scale-insects that still remained on them had also perished, though those on the other parts of the tree seemed in no wise affected. All the branches of the fig-trees in which the cavity was left empty were perfectly healthy. Thus the death of the branches was clearly due to the action of the potassium ferro-cyanide, and the trees appear to have reacted in some way to this toxic effect by producing the coloured liquid which exuded from the wounds.

The author then applied the same treatment to other species: *Pinus pinea*, *P. sylvestris* and privet (*Ligustrum*). These did not appear to suffer in any way though a very small quantity of the bluish liquid (resinous in the case of the conifers) was observed to flow from the wound. Two of the pines which were covered with caterpillars were not freed from these pests, and none of the insects were found dead near the tree trunks, although the last year the experiment was made just at the time the caterpillars appeared.

Without in any way casting doubts upon the results obtained by SANFORD who experimented upon other trees and other species of parasites, the author states that: 1) crystalline potassium ferro-cyanide is injurious when introduced into the trunk of the fig-tree; 2) *P. pinea*, *P. sylvestris* and privet all seem to resist its toxic action; 3) no toxic effect appeared to be exerted upon the caterpillars on the trees treated. Whether or not the scale-insects of the fig-tree were affected is a matter of

(1) See R. Feb. 1915, No. 235; R. Oct. 1915, No. 1103; R. May 1916, No. 506. (Ed.)

(2) See R. Feb. 1915, No. 235. (Ed.)

little importance, seeing that the parts of the tree where the scale-insects perished were themselves destroyed.

The author considers that the toxic effect of potassium ferro-cyanide is increased in the fig-tree by the presence of laticiferous tubes, which are absent in the trees which were able to resist the poison. He intends to make further experiments with the object of clearing up this point.

219 - **Experiments in the Control of the Olive-Fly (*Dacus Oleae*) by Means of the Lotrionte System of Traps ("capanette dachicide"), in Spain and Italy (1).** —

I. AGUILÓ Y GORSOT, J., in *Revista del Instituto Agrícola Catalán de San Isidro*, Year I, XX, Part. II, pp. 213-215. Barcelona, Nov. 1921. — II. MARINUCCI, M., in *La Nuova Agricoltura del Lazio*, Year IX, No. 214, pp. 143-144. Rome, December 1, 1921.

I. — In 1921, the campaign against the Olive Fly (*Dacus oleae*) was carried out with great energy in the Province of Tarragona, Spain.

The control method preferred at Samá Park at Cambrils, was Lotrionte's "Capannette dachicide" system. These "Capannette" are small shelters made of tin, or preferably of galvanised iron, bent into one or two ridges, and containing a little bundle of twigs sprayed with a poisonous mixture. At Cambrils this method was adopted for two thousand olive trees, the roof of the trap being made of uralite.

A gang of workers was first of all formed to make the bundles of twigs and suspend them with wire beneath each "capannetta". By June 20, each tree was provided with a trap and the spraying with insecticide began.

In the formula used honey was an excellent substitute for molasses, no difference in the inherent value of the mixture being caused by the change. As the sweetening power of honey is greater than that of molasses, 14% less of honey than molasses is required. The formula used at Samá Park was as follows: water 57 litres, honey 18 kg., borate of soda 1 kg., boric acid 1 kg., arsenate of soda 1 kg.

The insecticide is sprayed upon the twigs fixed to the trees beneath their "capannetta", by means of an ordinary knapsack-sprayer used for vines. A man can treat over two hundred trees per hour, and with 15 litres of the insecticide (the capacity of the sprayer) he sprays 215 "capannette", i. e. 215 trees. On the 8th, 18th and 20th of July, August and September the twigs were sprayed a second time; they were treated twice only in October, viz., on the 8th and 28th.

This experiment proved that the adoption of the Lotrionte method entirely protected the olive-trees of Samá Park from the attacks of the "fly". In point of fact, however, owing to the meteorological conditions obtaining in 1921, the season was not a favourable one for the increase of the parasite. Still, the Samá trees were free from attack whereas those on other estates where the same system had been negligently carried out, or wholly omitted, suffered from the Olive-Fly to a small extent.

(1) See also *R.* July 1911, No. 2369; *R.* March 1913, No. 323. (*Ed.*)

The cost of spraying is as follows :

2000 "capannette"	940 <i>pesetas</i>
affixing capannette to trees	150 "
130 kg. of insecticide.	75 "
Wages paid for spraying	15 "

The cost price of the substances used for the spray were : honey, 2 *pesetas* per kg., borate and arsenate of soda, 2.50 *pesetas* per kg., boric acid, 4.50 *pesetas* per kg.

As the "capannette" when once fixed on the trees, last for some years and the depreciation extends over five years, the cost per olive tree may be estimated at about 0.11 *pesetas* per annum. This also includes the cost of the wire used for suspending the traps from the trees. Thus in the case of 2000 olive-trees, the outlay according to the above figures, would be :

Depreciation of the "capannette" and wire and fixing	.
of the same	220 <i>pesetas</i>
1300 kg. of poison mixture	750 "
Wages paid for control work	150 "

The cost per 100 trees would thus be 56 *pesetas*, and if 20 % is subtracted for the increased price obtained for the fruit, the outlay per tree would be reduced to 45 *pesetas*, or 0.45 *pesetas* per tree.

The prices quoted above for the insecticide are a little higher than the normal ; it is clear, that, if the ingredients had been bought in large quantities by agricultural syndicates, or official institutions, and distributed to the agriculturists, the expense could have been reduced 20, or 25, %.

II. — Report on the results obtained in Italy in the control of the Olive fly by the Lotrionte method.

This work was begun in 1921 in the experimental olive yard of the "R. Scuola pratica d'agricoltura" of Rome (farm of S. Alessio in the Campagna Romana).

In 1921, Prof. Lotrionte wished to try a better poison mixture and also a new type of "capannetta" of a very simple kind, made of strands of reeds bound solidly together with string. The insecticide is directly applied to the inner surface of the bell-shaped "capannetta" to which it adheres better owing to the larger surface presented by the numerous projecting courses of the material. Such a "capannetta", which can last well for two years, is cheaper than the original type with a tin roof, and offers two distinct advantages : it does not get heated by the sun and thus provides a more agreeable refuge for the "fly" ; it excites less suspicion in the insects which alight even on the outside of the trap, for which reason the exterior also should be sprayed a little each time when the interior is treated.

These "capannette" are easily sprayed with an ordinary sprayer with intermittent action.

The insecticide remains in excellent condition for over twenty days on the surface of the "capannette", because it is very hygroscopic and

viscous, and contains no putrescent substances of which the odour would serve to repel instead of attracting the "fly".

The experiment was carried out on 700 average-sized trees (average diameter of foliage 5 m.), belonging to the College experimental oliveyard, and on 300 other trees in the neighbourhood, which were all that remained of olive-yards that were in course of being abandoned.

Only 700 "capannette" were used and none were affixed to small trees or specimens without fruit. Several control olive-yards were employed, these lay to the North-West, North-East and South-West respectively. The first (Lazio farm), contained a little over 200 trees, the second (Torlonia vineyard) had over 400, but both were about one kilometre from the experimental ground. The third, a larger oliveyard with over 1000 trees belonging to the Cecchignola farm, was about two kilometres distant. In the other directions there were no olive-trees within at least three kilometres. The zone treated was thus well isolated. The special Lotrionte mixture was applied four times to the "capannette" at the following periods: 1) June 30-July 2 (it took three days to attach the "capannetta" to each tree, for this was done by two of the college pupils during the afternoon hours set apart for field-work); 2) July 25-26; 3) September 12; 4) October 4-5.

Between the middle of July and the end of August, two sprayings of acid Bordeaux mixture were also given for the control of "Occhio di pavone dell'olivo" (*Cycloconium oleaginum*).

The insecticide used in this experiment was composed of: 50 % glucose; 2 % glycerine; 2 % boric acid; 2 % borate of soda; 2 % arsenite of potash; 2 % extract of Gorgonzola. Prof. LOTRIONTE is trying other less costly and more deadly formulae, and will make them known as soon as his researches and the experiments which he is carrying out are completed.

On November 10, a Commission was formed consisting of Professors B. GRASSI, Director of the Institute of Comparative Anatomy of the Royal University of Rome, and of the annexed Laboratory of Agricultural Entomology; A. MANGO, Royal Inspector of the Diseases of Plants, and M. MARINUCCI, in his two-fold capacity of Director of the "R. Scuola pratica d'agricoltura" of Rome and representative of the "Società nazionale degli olivicoltori".

According to the statements in the report of the Commissioners, the fruits of all the trees in the zone treated (experimental olive-yard), were fine and free from injury, except for the bruises caused by the hail of September 22. It is noticeable that this observation applied as much to olive-trees with large fruit containing a quantity of juicy pulp and to the "ros-ciola" variety, which has small olives that are soft and juicy, and hence very liable to the attacks of the "fly", like other varieties with average sized or small olives.

Samples were taken from many trees of different varieties growing in the zone treated and from these an average sample was made. This when examined on the spot, gave the following results: perfectly healthy olives

free from the "fly", 95 %; olives attacked by *Dacus oleae* 2 %. The Commission also noted that the pulp of the few olives attacked was as a rule but little affected, so that it could still yield much oil of a good quality. Few of the fruits had fallen, and even those on the ground were found to be free from the insect.

In the first control olive-yard visited (the Torlonia vineyard), the Commission immediately found the trees to be severely infested, especially those bearing large and medium-sized fruits, 90 to 100 % of which were attacked. From 30 to 40 % of the very small fruits of the "olivastrì" (seedling trees that have not been grafted) harboured the pest, although they are usually left untouched or slightly injured, either because they gave little pulp, or on account of their late ripening. Samples were also taken from many varieties of trees in this control olive-yard, and an average sample made, which on being examined in Rome at Prof. GRASSI's laboratory, gave the following results: sound olives 23 %; olives attacked by the "fly" 77 %. The observations made in this oliveyard together with the results of the laboratory examination of the sample of olives gathered, showed that: 1) The few olives that were not attacked by the "fly" grew on "olivastrì" and other kinds of olive-tree with small late-ripening fruits; 2) the infection in the case of trees with large and average fruits was never below 90 %; 3) the pulp of olives infested by *Dacus oleae* was, for the most part eaten away and much damaged, so that it yielded only a little oil of poor quality.

The sample of olives taken from the control olive-yard at the Lazio farm was examined by Prof. GRASSI with the following results: sound olives 1 %; olives attacked by the "fly", 99 %.

The olives gathered in the third control olive-yard (Cecchinola farm), were also found by Prof. GRASSI to be seriously attacked by the pest. No percentage was however calculated, as the crop was rather small and all produced by "olivastrì".

The very high proportion of infected fruit on the Lazio farm is partly attributable to the small yield of the trees, which had borne a heavy crop the preceding year. The pulp of these olives was so much destroyed that only a little oil of bad quality could be obtained.

As a result of their observations and the data collected, the Commission concluded their report with the statement, that the experiment made in 1921 at the experiment olive-yard of the "R. Scuola pratica d'agricoltura" of Rome had been most successful and that without doubt the system of control adopted is as efficacious as it is practical.

220 - The Potato-Tuber Moth (*Phthorimaea operculella*), in the Department of Hérault (1). -- LICHTENSTEIN, J., and GRASSÉ, P., in *Bulletin de la Société entomologique de France*, No. 18, pp. 267-268. Paris, 1921.

The author considers that the potato-tuber moth (*Phthorimaea operculella*, Zeller), found its way into Drôme and Hérault through consign-

(1) See also R. January 1920, Nos. 54 and 150; R. May 1920, No. 600; R. April 1921, No. 443. (Es.)

ments of infected potatoes. Potatoes containing the larvae of the moth were actually observed on the market at Montpellier, but the origin of the vegetable could not be exactly determined. Further, all the stored potatoes from a consignment coming from Montpellier itself were found to be infested. The moths were just emerging, for the authors saw some of them flying in the garden. Potatoes are not cultivated on an extensive scale in the district of Montpellier, but a certain number are grown by local gardeners, and large stocks coming from different regions are stored to supply the town. From the imported potatoes the moth could therefore easily penetrate into those parts of the Department where farm crops of these vegetables are raised. Hence, it is most important that its first appearance should at once be reported, and the infected tubers either destroyed, or covered with sand in order to prevent the emergence of the moth.

221 - *Ceroplastes* sp., a Scale-Insect Injurious to the Maté (*Ilex paraguayensis*), in the State of Paraná, Brazil. — *Chacaras e Quintas*, Year XII, Vol. XXV, No. 6, pp. 467-468, fig. 1. São Paulo, December 15, 1921.

Among scale-insects lately reported as harmful, one new species has so far not been specifically determined: it belongs to the genus *Ceroplastes* and was discovered in the State of Paraná, where it attacks the maté (*Ilex paraguayensis*).

The branches and leaves of the host-plant assume a blackish colour, and the leaves, especially on their upper and the edges of their lower surfaces, are covered with black, apparently sooty, powder formed by the mycelium and fructifications of a Perisporiaceae (sooty mould), the growth of which is encouraged by the secretions of the scale-insects that adhere to the branches of the tree.

The following formulae are most commonly employed in the control of *Ceroplastes*:

1) black soap, 500 gm.; crude petroleum, 8 litres; water, 4 litres to be used for as a spray.

2) paraffin, 500 gm., vegetable oil of any kind, 800 gm.; ordinary soap, 1 kg.; water, 4 litres to be applied directly with a brush, or used as a spray.

Another treatment consists in cleaning the infected parts of the plant with soap, or tobacco extract, applied by means of a coconut brush or metal glove.

As the scale-insects increase with great rapidity, it is advisable to take the following precautions:

- 1) To keep the plantations as clean as possible;
- 2) To remove and burn all infected trees.

222 - *Lochmaea sanguinolenta*, a Coleopteron Injurious to the Melon in Catalonia, Spain. — AGUILÓ, J. in *Agricultura*, Year V, No. 13, pp. 354-355, fig. 1. Barcelona, 1921.

In September 1920, a whole crop of melons in the Province of Tarragona was completely destroyed by the Coleopteron, *Lochmaea sanguinolenta* Fabr., which had not previously been reported as injurious to *Cucumis Melo*.

The beetle devours the shoots and leaves of the plants while still quite young thus arresting the growth of the seedlings, which succumb to its persistent attacks. The few plants that survive are weakly and bear very few melons, which are of small size and acid flavour. *L. sanguinolenta* also frequently deposits its eggs on the leaves of its host, and as the larvae when hatched live entirely on the subterranean portions of the melon, the plants soon perish.

The following formula has proved efficacious in the control of the insect: 400 gm. of arsenate of sodium anhydride containing 60 % arsenic acid, 1 hectolitre of water, and 1 kg. slaked lime. Two sprayings at an interval of 5 or 6 days are sufficient.

223 - *Xylostodoris luteolus*, a Rhynchote Injurious to the Palm *Oreodoxa regia* in Florida. — MOZNETTE, G. F., in *The Quarterly Bulletin of the State Plant Board of Florida*, Vol. VI, No. 1, pp. 10-15, pl. 3. Gainesville, Florida, October 1921.

The presence of a Rhynchote causing great injury to the palm *Oreodoxa regia* has been recently reported from South Florida. The insect was described for the first time in October 1920, under the name of *Xylostodoris luteolus* Barber, from specimens collected at Santiago de las Vegas (Cuba), where the pest also does great damage to the same palm.

In March 1920 the author received from Coconut Grove (Florida), portions of leaves of *O. regia* that had been seriously injured by an insect which he recognised as *Xyl. luteolus*. This is the first time that the rhynchote has been reported as occurring in the United States.

The insect attacks only the young and tenderest segments of the leaves of the top of the tree and of any rachis that is not unfurled. Since it shuns the light, it abandons the leaves as they begin to develop. A white spot forms on the leaf-segment attacked, after the puncture made by the Rhynchote in order to extract the plant juices upon which it lives. The spots increase in number and coalesce and the injured portion of each segment turns brown and dies.

The palm therefore soon assumes a very unsightly appearance.

After making many preliminary control experiments on small specimens of *O. regia*, living in the open and infested with the parasite, the author found that a mixture of one part of 40 % sulphate of nicotine in 1200 parts of water gave excellent results, for it killed the insect without doing any perceptible injury to the young growing tissues of the palm. Some fish-oil soap was added to this mixture (2 kg. being introduced into a receptacle having a capacity of 450 litres). A subsequent investigation of the palms that had been sprayed showed that 75 % of the insects succumbed to the first application. A second treatment was effected a week later which practically freed the palms from the insects, so that the trees began to put forth new, vigorous, healthy and handsome leaf-segments.

224 - Insects Injurious to the Banana in Porto Rico. — See No. 177 of this Review.

[223-224]

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